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S.I. OGNEV

MAMMALS OF THE U.S.S.R. *AND* ADJACENT COUNTRIES

Volume IV

RODENTS

Translated from Russian

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S.I. Ognev

MAMMALS of the U.S.S.R. and ADJACENT COUNTRIES

(Zveri SSSR i prilezhashchikh stran)

MAMMALS OF EASTERN EUROPE AND NORTHERN ASIA

(Zveri vostochnoi Evropy i severnoi Azii)

Vol. IV

Rodents

(Gryzuny)

Izdatel'stvo Akademi Nauk SSSR
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FOREWORD

The fourth volume of "Mammals of the U. S. S. R." deals with the Order Glires (Rodents).

Numerous books have recently been published on the rodents of the U. S. S. R., which contain extensive and detailed surveys of the ecology and geographical distribution of some of the best-known and most interesting representatives of the order, e. g., squirrels, spermophiles, the blue hare and the European common hare.

This book is as broad in scope as the preceding volumes, and can be used as a reference book. I have endeavored to use all the available taxonomic, zoogeographical and biological literature. Some of the surveys are rather extensive and I hope the reader will not mind this.

The fourth volume contains several innovations. Species are treated in detail; subspecies are described separately. This results in greater accuracy of the descriptions. Following the suggestion of critics, dichotomous keys have been replaced by Swedish keys (instead of the more complicated English keys). The amount of material used has been indicated in each case.

The illustrations were prepared with the greatest care. Original drawings of skulls were made with a pantograph by S. Yu. Kostylev, Scientific Associate of the Moscow State Zoological Museum. Many photographs taken by myself are given, as well as half-tone plates by Prof. A. N. Formozov, A. N. Komarov, and K. K. Flerov. The color plates [reproduced in black and white in this translation] were made by V. A. Vatagin.

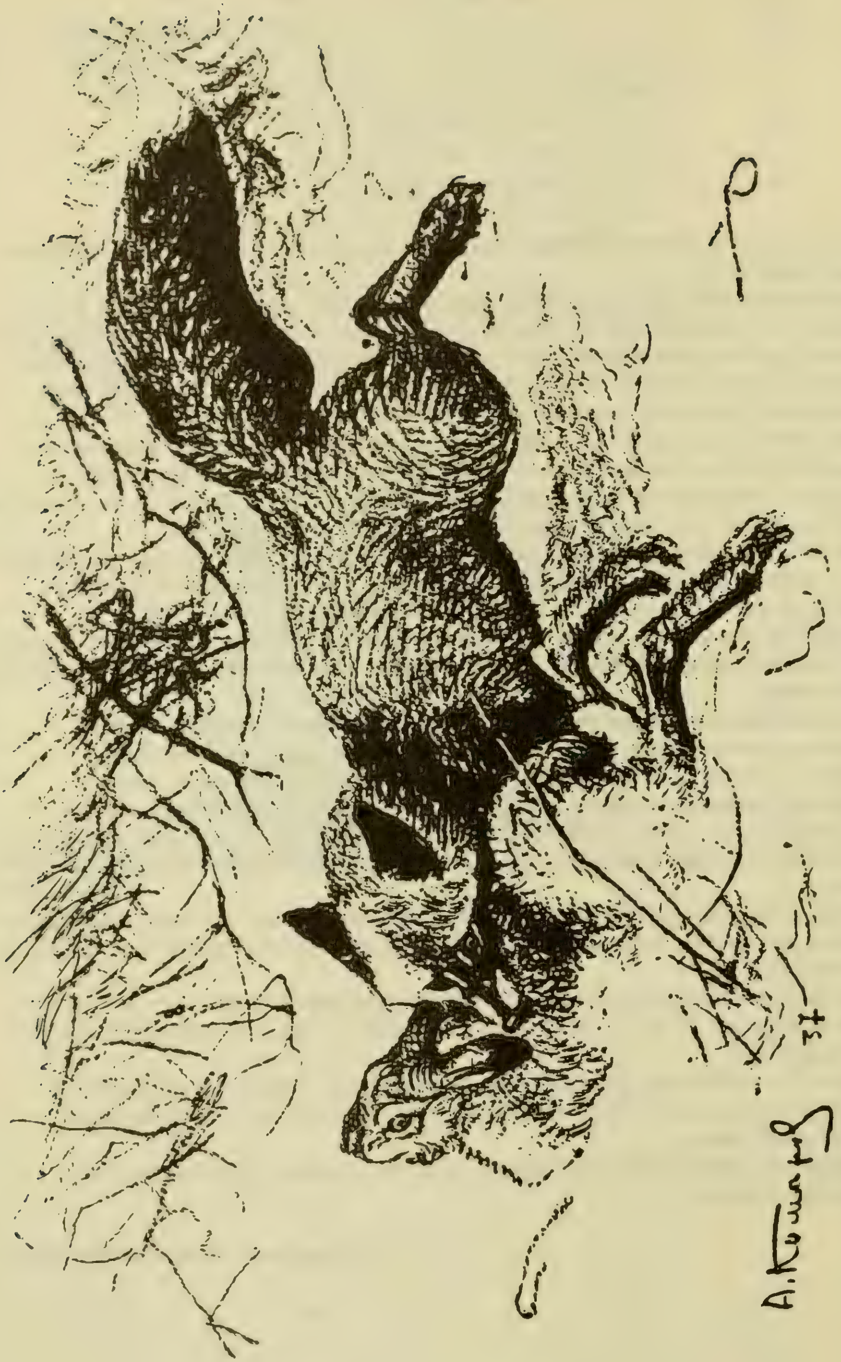
Diagrams of cranial measurements of pikas, hares and spermophiles are given for better understanding. Such diagrams are more instructive than descriptions.

The successful completion of this extensive work is largely due to the generous support of V. M. Molotov, Chairman of the Council of People's Commissars.

I wish to record my gratitude to the Scientific Research Institute of Zoology of the Moscow State University for providing most favorable conditions for work.

It is hoped that this fourth volume will be received as well as the preceding volumes.

Moscow, 25 November 1936


А. Комаров 37

Fox with captured common hare

11 # GLIRES LINNAEUS.

RODENTS

ORDER FIVE

GLIRES LINNAEUS (RODENTIA VICQ. D'AZYR)

RODENTS

Rodents are the largest mammalian order, consisting of more than 2800 species. They are chiefly small pentadactyle, unguiculate mammals with a plantigrade or semiplantigrade gait. Their dentition is very characteristic. There is only one pair of incisors in the upper and lower jaw. Only Lagomorpha and Ochotonidae have a second pair of small incisors behind the large pair of upper incisors. The incisors are chisel-shaped, rootless, and grow throughout life. Under normal conditions their growth is compensated by their permanent wear. Between the incisors and premolars there is always a large space called diastema which is caused by the permanent absence of canines. The surface of the molars may be plane (as in Microtinae), or bear blunt tubercles. The primitive type of molars is brachydont or bunodont. They later become hypselodont, and their surface becomes lophodont.

The teeth are adapted to gnawing and grinding a vegetarian diet, including hard matter such as wood and bark. The mandibular condyle is generally elongate in a longitudinal direction. The tympanic bones form the hollow or spongiose wall of the auditory bullae (bullae osseae). The orbit communicates with the temporal fossa. The infraorbital canal is often very long, as part of the masseter muscle runs through it. The premaxillaries frequently have posterior processes which reach the frontal bones, partly separating them from the maxillaries. The clavicles are markedly reduced. The tongue has only 3 circumvallate papillae. Intestine adapted to vegetarian diet. Stomach relatively simple, intestine very long, and cecum well developed. Brain macrostatic and hemispheres usually smooth, not covering cerebellum.

12 Testes lying either permanently in the abdominal cavity or in an inguinal sac, rarely in the scrotum. Uterus double (uterus duplex). Placenta discoidal and deciduate.

The external structure of rodents is adapted to greatly variable conditions of life. Some rodents are arboreal. Others are burrowing and are adapted to underground life in a varying degree. Some rodents are aquatic, and are adapted to prolonged swimming and diving. Some species of the order are excellent runners, being equipped with very long and specialized posterior limbs. Rodents also include a few "flying" species. Skin folds between the fore- and hind limbs form a so-called parachuting membrane thus enabling them to glide (e.g., flying squirrels).

Rodent distribution is worldwide. They live in different habitats which are reflected in their biological adaptations: highlands, plateaus, steppes, deserts, tundras, and forest zones. Aquatic species occur in rivers and lakes.

Rodents are divided into two suborders, distinguished according to the following key:

1 (2). Incisors $\frac{2}{1}$, i.e., an additional small pair of incisors behind the pair of large incisors in the upper jaw. Distance between rows of upper molars larger than that between rows of lower molars. Optic foramina fused. Cecum with spiral fold.

Suborder Duplicidentata.

2 (1). Incisors $\frac{1}{1}$, i.e., one incisor on each side of upper jaw, an additional pair of small incisors absent. Distance between rows of upper molars either smaller or equal to that between rows of lower molars. Optic foramina separate. Cecum without spiral fold.

Suborder Simplicidentata.

First Suborder. *DUPLICIDENTATA*

A second pair of smaller incisors present behind the first pair of large upper incisors (i $\frac{2}{1}$). Incisors entirely covered with a layer of enamel which is very thin on the posterior surface but thick on the anterior surface, forming the characteristic cutting edge of the teeth.

Number of molars varying between $\frac{6}{5}$ and $\frac{5}{5}$. Number of premolars constant: $\frac{p_2p_3p_4}{p_3p_4}$; number of molars varying between $\frac{3}{3}$ in Leporidae to $\frac{2}{3}$ in Ochotona. In some extinct Ochotonidae, e.g., Prolagus Pom. (lower European Miocene), the number of molars was reduced to $\frac{2}{2}$.

Molars rootless, hypselodont with deep enamel folds on crown; cement
13 embedded between the enamel folds. F. Major showed that the specialized hypselodont teeth of Duplicidentata evolved from primitive bunodont and brachydont teeth. The elevation of the crown of the molars in the upper jaw is less marked on the inner than on the outer side. As a result, the crowns of the upper molars are beveled towards the outside, and in the opposite direction in the lower molars. The distance between the rows of upper molars is greater than that between the lower rows. Duplicidentata grind their food by lateral movements of the rows of molars. The lower rows of molars are laterally surrounded by the upper ones.

The glenoid fossae for the mandibular condyles of Duplicidentata are therefore relatively wide transversely. This facilitates lateral movements of the mandibula and of the molars. Both halves of the mandibula are rigidly connected by the symphysis.

The optic foramina are fused, and the infraorbital foramina are narrow and small. The bony palate is strongly reduced to a narrow transverse bridge behind the large palatine foramina. This bridge of the bony palate consists mainly of the paired maxillary processes (processus palatini ossis maxillaris) in hares. In pikas the greater part of this bony bridge consists of the palatines. The maxillary palatine processes are small, narrow, not joined with each other in all pikas. They form the anterior (frontal) margin of the bony palate. In primitive species of hares the bony palate is broader than in more specialized ones. The clavicles may be rudimentary or well developed.

The soft palate bears many folds. The long cecum is equipped with a spiral fold.

Os penis little developed; tip of penis directed backwards.

All the characters mentioned above prove that the Duplicidentata are less specialized and more primitive than the Simplicidentata.

KEY TO FAMILIES OF DUPLICIDENTATA

1 (2). Tail inconspicuous; both pairs of legs of about equal length. Nasals widening anteriorly. Postorbital processes absent. Walls of bullae osseae spongiose. Molars $\frac{5}{5}$. — Lagomyidae (Ochotonidae).

2 (1). Tail short but well developed; anterior legs about half as long as the posterior ones. Nasals not widened anteriorly. Postorbital processes present. Walls of bullae osseae solid, i. e., not spongiose. Molars $\frac{6}{6}$. — Leporidae.

Family LAGOMYIDAE, PIKAS

1866. Lagomyidae, Lilljeborg, W., Systematisk öfversigt af de gnagande däggdjuren, Glires. Nova Acta Soc. Scienc., Upsala, Vol. VI.

14 1897. Ochotonidae, Thomas O., Types in Natural History and Nomenclature of Rodents, Science, VI, pp. 485-487.

1897. Lagidae Schultze Erw., Helios XIV, S. 82; Catalogus Mammalium europaeorum, Ztschr. f. Naturwissensch., Bd. 73, 1900, S. 209.

1910. Ochotoninae (subg.)., Trouessart E. L., Faune de Mammifères d'Europe, p. 213.

Ochotonidae are characterized by short, rounded ears and short posterior legs which are little longer than the anterior legs. Tail strongly reduced.

Nasals widening anteriorly; postorbital processes absent. Lateral parts of maxillae not cribriform. Skull relatively low, usually flattened. The skull is convex dorsally only in some species of the family. It seems much flatter than that of hares in general. The bullae osseae are large, elongate, obliquely directed inwards towards the median line of the skull. The bony walls of the bullae osseae are spongiose.

Clavicles well developed. Pubic symphysis absent.

Dentition: $i\frac{2}{1}$; $c\frac{0}{0}$; $p\frac{3}{2}$; $m\frac{2}{3}$ (or $\frac{2}{2}$) = (26 or 24).

The family Lagomyidae contains only the genus Ochotona Gray which is divided into the 3 following subgenera: Ochotona s. str., Pika Lacépède and Conothoa Lyon*.

---

* Pikas of the pusilla-tibetana group apparently form an additional subgenus. Ochotona kozlovi Büchner constitutes a sharply differentiated subgenus. Ochotona thomasi Argyropulo also probably represents a separate subgenus. This species was described by A. I. Argyropulo (in litt.) from a specimen from the vicinity of Lake Alyk-Nor (Northeast Tibet) which was captured by the expedition of P. K. Kozlov on 31 May 1901. This specimen differs sharply from all other pikas by its well proportioned, narrow and unusually elongate skull. I know of only one skull of this species in the ZMAN ["Zoologicheskii muzei Akademii Nauk" (Zoological Museum of the Academy of Sciences)] collection.

GEOGRAPHICAL DISTRIBUTION. Pikas are distributed from Eastern Europe (from the Trans-Volga region) throughout Eurasia. Their range extends from the northern limit of the Arctic tundras, through the Boreal region, to the mountainous countries of southern Turkmenia, northern Iran, Seistan, the Himalayas, Kansu, and Szechwan. They are also sporadically distributed in the Nearctic region, from the Tundra-Boreal regions of Alaska to California and Colorado (A. Howell, Revision of the American Pikas, U.S. Department of Agriculture, Washington. 1924).

Genus **Ochotona** Link

1773. Lepus Pallas P., Reise durch verschiedene Provinzen des Russischen Reichs, Bd. II, Anhang, S. 701-702 (partim!), Lepus Linnaeus. 1758.

1795. Ochotona Link H. F., Beitrage zur Naturgeschichte, Bd. I, Theil 2, S. 74 (type Ochotona minor Link. = Lepus ogotona Pall. =Lepus dauuricus Pallas).

1799. Pika Lacépède Bern. G. E., Tableau des divisions des Mammifères, Paris, p. 9 (type Pika alpinus =Lepus alpinus Pallas).

1800. Lagomys Cuvier G., Leçons d'anatomie comparée, Vol. I, tab. I (Lagomys Storr, Prodromus Methodi Mamm., 1780, pp. 34-40; this description was apparently made according to an Arctomys specimen).

1867. Ogotoma Gray I. E., Notes on the Skulls of Hares and Pikas in the British Museum, Annals and Magazine of Natur. History, Vol. XX, p. 220 (type Ochotoma Pallasii=Lagomys ogotona Waterhouse, Lepus ogotona Pallas).

1904. Conothoa (subgenus!) Lyon M. W., Classification of the Hares and Their Allies, Smiths.
15 Miscellan. Collections, Vol. XLV (I), parts 3-4, p. 438 (type Ochotona roylei Ogilby).

The species of the genus Ochotona have the general characters of the family Lagomyidae. Additional characters are as follows: trunk compact, rounded, tailless, limbs short, posterior legs only little longer than the anterior ones. Paws very furry. Forefeet pentadactyle, hind feet tetradactyle. All digits with short, sharp, curved claws. The underside of the tip of each digit has a bare callus in summer fur. Ears of moderate length, shorter than those of Leporidae, rounded and furry on both sides. Eyes small, compared to those of hares. Fur dense, soft, often silky in winter. Color of summer and winter fur usually sharply different. Teats 4 or 6, distributed as follows: p 1-1 (or 2-2); i 1-1*.

Rostrum of flattened skull narrow, this being a reliable difference between the genus Ochotona and the Leporidae. Bony palate shortened. Zygomatic bones with backward-directed, pointed processes. The ascending part of the mandibula has a strongly developed condyle. The anterior surface of the ascending part has no longitudinal fossa such as observed in Leporidae.

The teeth of Ochotona have some typical characters which distinguish them clearly from those of hares. The cutting edge of the upper anterior pair of incisors has a deep, acutely angular notch. The edge of each tooth seems divided into 2 pointed processes. The inner point is much narrower and sharper than the outer. In Leporidae the cutting edge of the upper anterior pair of incisors also has an angular notch, but the edge of each tooth seems divided into 2 rounded processes and the inner process is only little smaller than the outer. The posterior lower molar is simple, with a single enamel cap. In Leporidae it has a double enamel cap. The structure of the second upper molar (m^2) differs sharply from that of the third premolar (p^3). In Leporidae these teeth are similar.

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* [p=pectoral, i=inguinal.]

The third upper molar is absent as a rule; in Leporidae it is always present.

Type species: Lepus dauuricus Pallas (1773).

THE GEOGRAPHICAL DISTRIBUTION of the genus is given in the description of the family.

KEY TO SPECIES OF GENUS OCHOTONA

1 (6). Underside of vomer exposed; lateral margins of premaxillaries not joined under vomer; palatine and incisor foramina fused.

2 (3). Interorbital region of adult skull relatively broad (5.2-6 mm) and flattened. Summer fur, various shades of grayish brown with an ocher tinge on back. Winter fur fluffy, pale grayish on back with a straw-yellow tinge.

Ochotona macrotis Günther. Large-eared pika.

3 (2). Interorbital region of adult skull relatively narrow and convex in profile.

4 (5). Length of skull not over 47 mm. Vibrissae 40-55 mm long; most vibrissae white, few very dark-
16 brown. Ears with well marked pale margins. Color of summer fur on back pale yellowish straw-gray to duller and darker straw-gray. Belly pure white. Neck without a broad pale collar.

Ochotona daurica Pall. Daurian pika.

5 (4). Length of skull in adults usually 46 mm to 53 mm. Most vibrissae dark brown; longest vibrissae with long white tips, 45 to 55 mm long. Ears without well marked pale margins. Summer fur light gray on back with straw-yellow tinge and rust-brown hair tips. Belly dirty-grayish white, often with a yellowish tinge. Neck with a broad pale ash-gray collar; an indistinctly marked rust-red band behind the collar.

Ochotona rufescens Gray. Reddish pika.

6 (1). Position of vomer in relation to edges of premaxillaries, and structure of palatine and incisor foramina different.

7 (12). Vomer ventrally covered by premaxillaries, which join each other and separate palatine and incisor foramina completely.

8 (9). Summer fur ocher-rust-gray on back with rusty tinge. Winter fur straw-gray on back with a pinkish rust tinge.

Soles white, sometimes with straw-grayish shades. Pale margins of ears very indistinct.

Ochotona pricei Thos. Price's pika.

9 (8). Color of summer fur on back light yellowish ocher to saturated rust-ocher or rust-brown, even black-brown-ocher. Winter fur differs sharply from summer fur in its gray or brownish gray color, frequently speckled with blackish hair.

Soles black or dark brown, sometimes grayish white or gray in small forms. Pale margins of ears quite well marked.

10 (11). Skull large, more than 43 mm long in fully grown specimens, and may reach 57 mm in old ones. Rostrum long; upper diastema usually much longer than upper row of molars, and longer than distance between inner margins of alveoli of last upper molars*.

Zygomatic width more than 22 mm; diastema longer than 9 mm. Hind foot (without claws) more than 30 mm.

Soles black or black-brown, gray in winter.

Ochotona alpina Pall. Altai pika.

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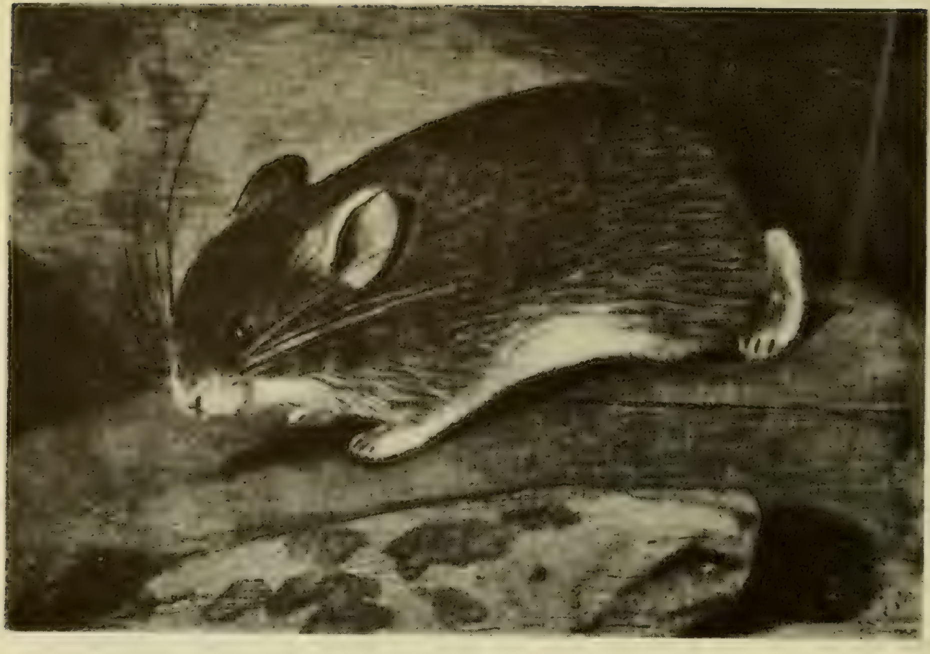
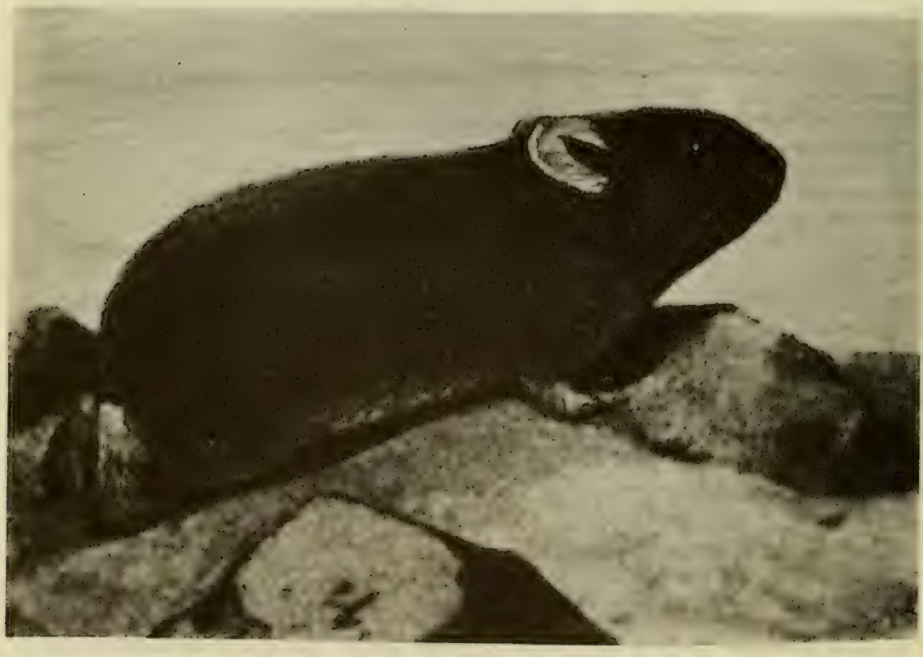
* These features are not very well marked in small subspecies of O. alpina, viz. O. a. svatoschi, O. a. cinereofusca. However, the diastema was always slightly longer than the upper row of molars and the distance between the inner margins of the alveoli of the last upper molars in specimens examined.



Red pika (Ochotona rutila Sev.)

Drawing by V. A. Vatagin



Altai pika (Ochotona alpina Pall.)

Drawing by V. A. Vatagin

11 (10). Skull much smaller, less than 43 mm long in fully grown specimens. Rostrum relatively short; upper diastema as long as row of upper molars and distance between inner margins of alveoli of last upper molars. Zygomatic width less than 22 mm; upper diastema less than 9 mm long. Hind foot (without claws) less than 30 mm long. Soles grayish brown or gray; whitish gray in winter.

Ochotona hyperborea Pall. Northern pika.

12 (7). Vomer not completely covered ventrally by edges of premaxillaries which are not narrowly connected, being separated by a narrow slit; the premaxillaries form a bridge between palatine and incisor foramina.

13 (14). Anterior third of nasals with marked spoon-shaped widening. Rostrum long. Upper diastema much longer than row of upper molars.

Vibrissae 94 mm long.

Summer fur on back rich rust-red; winter fur on back ash-gray.

Ochotona rutila Severtz. Red pika.

17 14 (13). Nasals very little widened anteriorly. Rostrum very short; upper diastema as long as row of upper molars.

Vibrissae short, not longer than 45 mm.

Summer fur on back deep grayish brown with more or less distinct straw-yellow mottling. Winter fur similar, generaly slightly paler.

Ochotona pusilla Pall. Small pika, or chekushka.

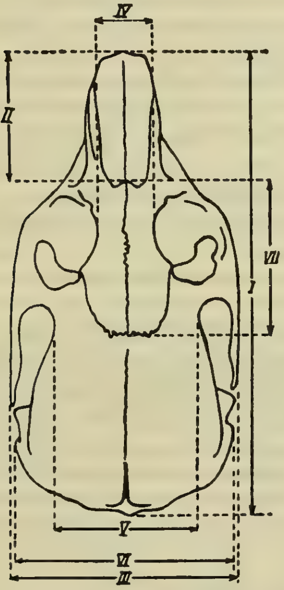


FIGURE 1. Skull measurements in pikas (Ochotona) (dorsal)

1 — length of skull; 2 — length of nasals; 3 — zygomatic width; 4 — interorbital distance; 5 — width of skull behind zygomatic arches; 6 — width at level of auditory meatus; 7 — length of suture between frontals.

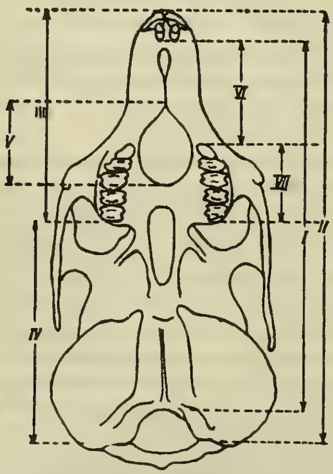


FIGURE 2. Skull measurements in pikas (ventral)

1 — basal length of skull; 2 — condylobasal length; 3 — length of facial region; 4 — length of brain case; 5 — length of palatine foramen; 6 — diastema; 7 — length of row of upper molars.

Subgenera of the genus Ochotona

O. Thomas (The Duke of Bedford's Zoological Exploration in East Asia. On Mammals from the Provinces of Shansi and Shensi, North China, Proceedings of the Zoological Society of London, p. 982, 1908) proposed the following subgenera of the genus Ochotona:

1) Ochotona Link, 1795 (=Conothoa Lyon).

Type species: O. daurica Pall. Palatine and incisor foramina fused and exposed.

2) Pika Lacépède, 1799 (=Lagomys C. Cuvier).

Type species: O. alpina Pall. nec Storr., 1780. Palatine and incisor foramina separate. Skull flattened in profile.

3) Ogotoma Gray, 1867. Type species O. pallasi Gray (=pricei Thos.). Palatine and incisor foramina separate. Frontal region of skull markedly convex.

18 This classification is based solely on the structure of the palate. This character is excellent for the differentiation of species, but is of little use for subgenera. Closely related pikas such as Ochotona macrotis Günth. and O. rutila Severtz. which were considered as one species by many authors would have been ascribed to different subgenera according to the structure of the palate. More accurately, O. rutila Severtz. would not belong to the above-mentioned taxon, as its palatine structure is intermediate: incisor and palatine foramina are connected by a very narrow slit which is sometimes almost occluded. According to its palatine structure, Ochotona erythrotis Büchn. would belong to the subgenus Pika and would thus be separated from O. roylei Ogilby, with which it is very closely related according to all external characters. Ochotona pricei Thos. is very closely related to O. daurica Pall. according to the structure of the palate, but belongs to a different subgenus. Ochotona pusilla Pall. is generally not included in the subgeneric system of O. Thomas.

The division of genus Ochotona into subgenera proposed by O. Thomas is thus unsatisfactory in our opinion.

In his monograph "Ochotonidae (Lagomyidae) SSSR" (Ochotonidae (Lagomidae) of the U.S.S.R. (1936)) A.I. Argyropulo offers a much better division in my opinion. He divides pikas into the following groups.

1) Daurica-curzoniae group including O. daurica, curzoniae, ladacensis, rufescens, pricei.

2) Roylei group including O. roylei, macrotis, rutila, erythrotis, gloveri, wollastoni, nubrica.

3) Alpina group including O. alpina, hyperborea, princeps, schisticeps, collaris.

4) Pusilla group including O. pusilla, tibetana.

5) Kozlovi group, considered by A.I. Argyropulo as a separate new subgenus.

Most of these groups can be designated by the former subgeneric names to which a new interpretation will have to be given (vide infra).

Subgenus **Pika** Lacépède

1799. Pika Lacépède B. G. E. Tableau des divisions des Mammifères, Paris, p. 9.

Skull strongly flattened in the interorbital and frontal region; frontal fenestrae as a rule absent. Interorbital space wide. Orbits relatively small. Vomer in all species of this subgenus covered ventrally by the margins of the premaxillaries. Palatine and incisor foramina separate.

Winter coloration dark brown, rust-brown or dirty-gray. Pads at tips of digits not well developed. Vibrissae relatively short, not longer than 70 mm.

Scree-inhabiting, semisylvan and sylvan species distributed in the tundra to the shores of the Arctic Ocean.

19 Type species: Pika alpinus = Lepus alpinus Pall.

The following species also belong to this subgenus: Ochotona hyperborea Pall., O. princeps Richardson, O. schisticeps Merriam, O. collaris Nelson.

GEOGRAPHICAL DISTRIBUTION. Tundra and mountain-forest zone of North Asia. All North American (Nearctic) pikas belong to this subgenus.

149. **Ochotona (Pika) alpina Pallas (1773). Altai or Alpine pika**

1773. Lepus alpinus Pallas P., Reise durch verschiedene Provinzen des Russischen Reichs, II. S. 701.

NAMES: Altai pika, mouse hare, cony (English); Der sibirische oder Alpen-Pfeifhase (German).

LOCAL NAMES: pol'skaya koshechka (Polish cat) (in many localities in Siberia e. g., in the Altai); ogoton (Russian, on the Lena); dikaya koshechka (wild cat) (Russian, in Siberia); shadak or shaidak (mountain-taiga region of the Minusinsk Territory); kamennaya koshka (stone cat); pishchukha (pika); piskun (squeaker) or senostavets (haybox) (Russian); dzhekulak (Kazakh, Kirghiz, Tatar); tiin-pishkan (Kirghiz); agas, chiss, daas-kila (living in screes) (Yakut); tachergana (Buryat); pika (Evenki, Tungus); Ogotona, or kuio (Mongolian); snikan (Birar Evenki-Tungus); chaptyrra (Evenki, Tungus on the Vitim); fulman (Ostyak, Khanty).

PRINCIPAL FIGURES: 1) Pallas P. S. Reise durch verschiedene Provinzen des Russischen Reichs, II, 1773, S. 701, Taf. II, B. (half-tone plate of entire animal); 2) Pallas P. S., Novae species Quadrupedum e Glirium ordine, 1778, pp. 45-49, tab. II. (entire animal); tab. IV A, 13 (A), 13 (B) (skull, lateral and anterior views); 3) Schreber I. Ch., Die Säugethiere, Erlangen, IV, 1792, S. 910-914, Taf. CCXXXVIII (entire animal, in color); 4) Dvigubskii, I. Opyt estestvennoi istorii vsekh zhivotnykh Rossiiskoi imperii (Natural History of the Animals of the Russian Empire), 1829, plate 26 (half-tone plate of entire animal); 5) Simashko, Yu., Russkaya fauna (Russian Fauna), II, 1851, p. 791-793, plate 63, fig. 2 (entire animal, color plate); 6) Brandt, I. F., Untersuch. über die craniolog. Entwick. und Classification der Nager, 1855, Pl. XI, Fig. 11-20 (skull and teeth); 7) Schrenck L., Reisen und Forschungen im Amur Lande, I, 1858, S. 150, Pl. VIII, Fig. 2 (Lagomys hyperboreus var. cinereofusca = Ochotona alpina cinereofusca (entire animal, color plate); 8) Brehm, A., Zhizn' zhivotnykh (Animal Life), II, 1874, p. 262 (half-tone plate); 9) Fokht, K., Mlekopitayushchie (Mammals), 1885, p. 402 (half-tone plate of entire animal); 10) Brehm, A., Zhizn' zhivotnykh (Animal Life), II, 1893, p. 675 (half-tone plate); 11) Tullberg, T., Ueber das System der Nagethiere, Upsala, 1899, Tab. I, Fig. 22-27 (structure of internal organs); 12) Gaake, V., Zhivotnyi mir (The Animal World), Vol. II, 1902, p. 33 (half-tone plate); 13) Vinogradov, B. S., Mlekopitayushchie SSSR (Mammals of the U. S. S. R.), I, 1933, p. 81, fig. 74 (skull, dorsal), fig. 75 (D) (incisor foramina of skull); 14) Sbornik: "Zveri Tadzhikistana" (Animals of Tadzhikistan), Trudy Tadzhikskoi bazy Akademii Nauk, 1935; Pavlovskii, E. N., Mlekopitayushchie kak vrediteli (Mammals as Pests), p. 54, fig. 23 (section through body wall of pika infested with Oestrid larvae).

MATERIAL EXAMINED: 127 pelts and skulls.

DIAGNOSIS. Skull large, length over 45 mm in fully grown and old specimens, 57 mm in very large specimens. Interorbital space flattened and broad in adult and old specimens, 5 to 6.3 mm wide. Anterior third of nasals without spoon-shaped widening. Lateral contours of nasals narrowing posteriorly, their posterior end rounded. Frontals without fenestrae. Vomer ventrally covered by margins of premaxillaries; palatine and incisor foramina separate. Most vibrissae black or dark brown, 60 to 70 mm long. Soles black or very dark brown. Ears with well marked pale margins. Coloration of summer fur in different subspecies light yellowish gray-ocher (on back) to saturated rust-ocher, sometimes with very dark brown-ocher tones. Winter fur sharply different from summer fur in its gray or brownish gray color, streaked with blackish hair. Completely melanistic individuals occur frequently.

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* Species and subspecies are numbered separately in this volume.

Body length may reach 250 mm (usually about 200 mm); hind foot may be 35 mm long (usually about 30 mm).

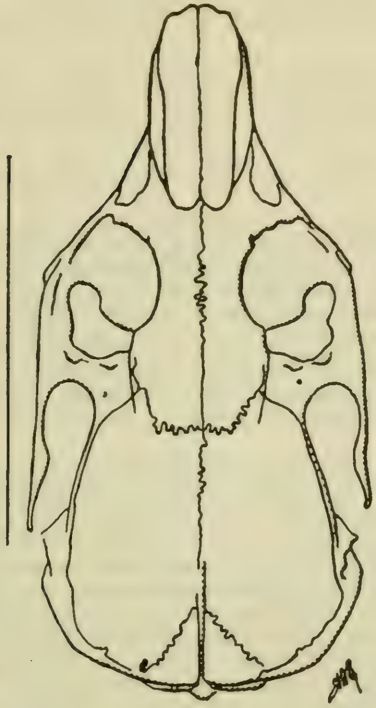

FIGURE 3. Skull of Ochotona alpina alpina Pall., dorsal. Specimen No. M. 327018 Dec. 18, 1929. Southern Altai, near Argat, Katon-Karagai. S. I. Ognev's collection

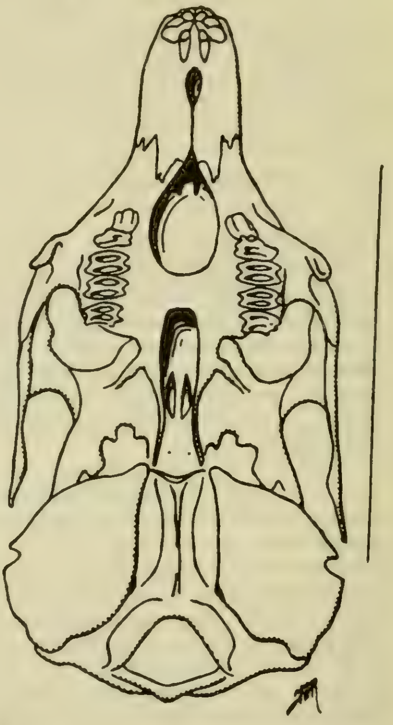

FIGURE 4. Skull of Ochotona alpina alpina Pall., ventral (same specimen as in Figure 3)

Drawing by Yu. A. Kostylev

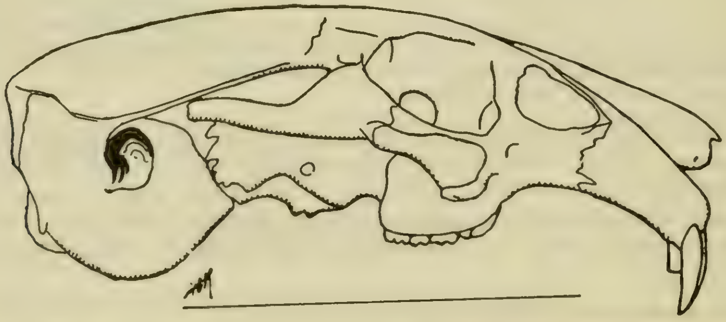

FIGURE 5. Skull of Ochotona alpina alpina Pall., lateral (same specimen as in Figure 3)

21 ADDITIONAL DESCRIPTION. Skull of Altai pika large, flattened; interorbital space broad, its margins without lateral facets. Anterior and posterior limits of upper contour of interorbital space have approximately the same curvature. Posterior quarter of nasal bones flattened but not depressed; nasals rounded posteriorly. Sagittal crest of old individuals well marked in occipital region, and in posterior part of parietals. Mandibular condyle massive and broad (Figures 3-6).

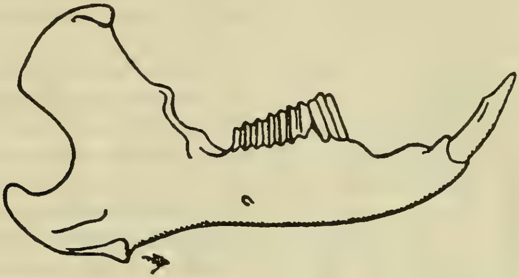

FIGURE 6. Mandibula of Ochotona alpina alpina Pall., (No. M.3270, Figure 3)

Age variation in skull structure well marked. Skull of young pikas convex in frontal region. Their skull is therefore not as flat as the skull typical of adult and old individuals. The parietals are also more inflated in young pikas. The posterior region of the skull in young Ochotona alpina is therefore more ovoid, and the interorbital space is broader than in fully grown individuals. The bullae osseae of young specimens not as long but more rounded and shorter. The short rostrum is also characteristic for the young skull.

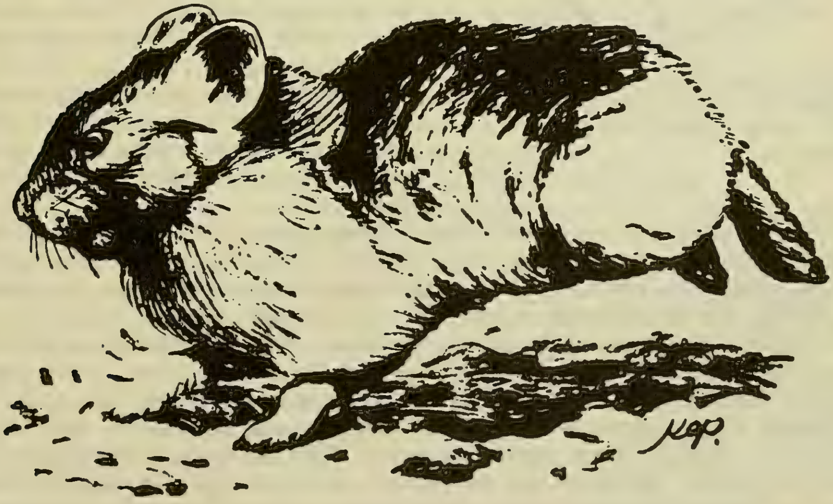

FIGURE 7. Ochotona alpina Pall., running
Drawing by K. K. Flerov.

22 The skull of the Altai pika is characterized by the structure of the vomer and the premaxillary processes. The vomer is completely covered ventrally in most specimens by the margins of the premaxillaries; the palatine and incisor foramina are therefore separate. This character is, however, variable. The margins of the premaxillaries sometimes do not join in young specimens and a narrow slit is left, through which the vomer is visible.

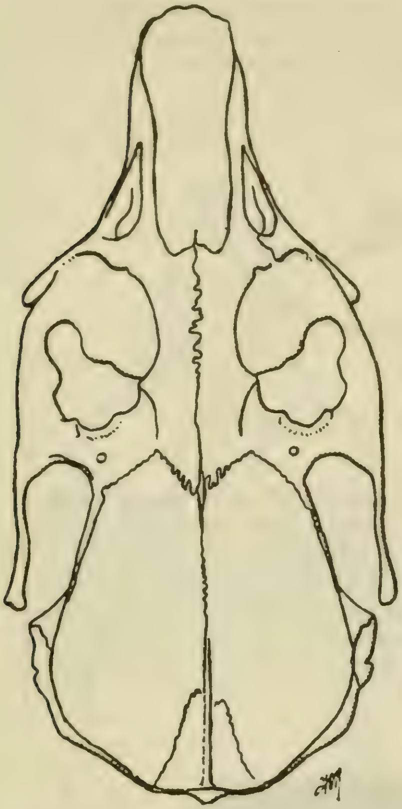

FIGURE 8. Skull of Ochotona alpina alpina Pall., No. 149, 1897. Central Altai, A. A. Silant'ev, KZMAN*. Very large specimen

Drawing by Yu. A. Kostylev

COLOR. (Plate I) The summer fur varies significantly in different subspecies. The general color of the back is dull, yellowish ocher-gray (tawny-olive, Ridgway, plate XXIX), darkened by black or dark brown hairtips in specimens from the Narym range. The flanks of these specimens have a marked rust-red tinge (pinkish cinnamon, Ridgway, pl. XXIX), belly pale, yellowish ocher, intermediate between pinkish cinnamon and cinnamon-buff (Ridgway, pl. XXIX) although lighter.

The color of pikas from the Chuya Alps (Chegan-Burgazy -O. alpina nitida Hollister) is more intense, of a dark brown shade (intermediate between mikado-brown and snuff-brown, Ridgway, pl. XXIX). Flanks colored a brighter rust-brown, close to sayal-brown and cinnamon (Ridgway, pl. XXIX). Many pikas from Teletskoe are even darker.

Summer color of the back is intense chestnut-brown; the middle of back and head quite black; rusty and ocher tones well marked on flanks (sayal-brown-cinnamon).

Ochotona alpina svatoshi Turov from the Barguzin Range is vividly colored. General tone of summer fur rich rust-ocher on back (sayal-brown, Ridgway, 1912) with an orange tinge (orange-cinnamon, Ridgway, pl. XXIX). Color of flanks almost the same as that of back.

In paler specimens of the Altai pika winter fur is dirty-ash-gray with a 23 marked black tinge caused by the very dark brown hair tips. Lower part of back with slight rusty tinge; flanks with clearly marked pale rust-yellowish tinge, intermediate between cinnamon and cinnamon-buff, (Ridgway, 1912). These pikas are widely distributed in the southern Altai (Narym Range), but there are also specimens with definite dull brown shades in their gray winter fur (sayal-brown and snuff-brown, Ridgway,

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* [KZMAN — Collection of the Zoological Museum of the Academy of Sciences of the U. S. S. R.]

1912, pl. XXIX). Flanks and belly in winter fur much browner with a clear ocher tinge (cinnamon and clay color, Ridgway, 1912, pl. XXIX).

The color of the summer fur of the young differs sharply from that of adult specimens in its light gray tone with only a slight rusty tinge. General color of back in these specimens intermediate between drab, hair-brown and mouse-gray (Ridgway, 1912, pl. XLVI and LI). The light rusty tinge (light pinkish cinnamon, Ridgway, 1912, pl. XXIX) is better marked on the flanks than on the back. Belly dirty-lead-gray with a slight rusty tinge.

SYSTEMATIC NOTES. In his earlier work "Reise durch verschiedene Provinzen des Russischen Reichs", II, 1773, S. 569, Pallas describes the morphology and biology of the Altai pika from specimens caught not far from Tigiretskoe in the Tigeretskii Range. This should be considered as the locus classicus for this species. In his book "Novae Species Quadrupedum e Glirium ordine", pp. 45-59, 1778, Pallas mentions the capture of an Altai pika in Sinyaya Sopka on the Kolyvan river (in a locality north of Tigiretskoe). This is also briefly mentioned in his earlier book.

Upon a careful systematic analysis of the Altai pikas, I arrived at the conclusion that several subspecies could be differentiated on the basis of color differences and characters of the skull. Pikas of the northwestern Altai do not differ from those of central Altai which are identical with the southern Altai form from the Narym Mountains. This race should therefore be considered as the typical Ochotona alpina alpina Pall. Very large specimens sometimes occur in the central Altai (Figure 8). Our collection has only a few such large specimens and it is therefore impossible to determine whether their size is accidental, or whether a very large race indeed inhabits the central Altai. Only collection of more material will enable us to solve this problem.

N. Hollister (1912) (Smithson. Miscell. Collect., Vol. 60, No. 14, pp. 4-5) described Ochotona nitida from the Chegan-Burgazy (the upper reaches of the Chuya) which is only a small subspecies of O. alpina distributed along the rivers Chuya, Chulyshman and in the region of the Teletskoe Lake. The same subspecies also lives in the Sayan Mountains. A well-characterized form, O. a. svatoshi Turov occurs in the Barguzin Range in Transbaikalia. O. a. cinereofusca Schrenck occurs in eastern and northeastern Transbaikalia, in the upper reaches of the Amur. A different form, O. a. scorodumovi Scalon is found south of the Gazimur Mountains. Finally, the peculiar subspecies O. a. changaica subsp. nov. lives on the Hangay Mountains. 24

We give below an analysis of the differences between O. alpina and O. hyperborea, which are undoubtedly very closely related.

It has been recently suggested that O. alpina and O. hyperborea should be considered as one species. A.I. Argyropulo has accepted this new classification, as far as I know, in his monograph in the series "Fauna SSSR" (Fauna of the U.S.S.R.) which is now in preparation. I should like, therefore, to clarify my complete disagreement with this suggestion.

O. alpina and O. hyperborea are certainly very closely related. A taxonomist could, however, identify O. hyperborea by its cranial characters and its short feet even if the animal were not labeled.

O. hyperborea is an east Siberian, boreal species. It occurs mainly in the forest of the Taiga and in the Tundra to the coast of the Arctic Ocean. The range of the Northern pika extends as far as Manchuria (Great Khingan Mountains), northern Mongolia and on the

Hangay Mountains. The range of O. alpina reaches from the Altai Mountains to Transbaikalia in the east and the Hangay Mountains in the south. The Altai pika lives in different habitats, namely screes and rocks. The ranges of these forms meet and overlap over a large area. Various subspecies of the Northern and the Altai pikas exist together in the same locality, where their specific ranges overlap. O. a. nitida Hollister and O. h. mantchurica Thos. occur together in the Sayan Mountains. O. a. cinereofusca Schrenck and O. h. mantchurica Thos. occur together in the Gazimur Mountains; O. a. changaica subsp. nov. and O. hyperborea subsp. in the Hangay Mountains.

It is hardly conceivable that all these forms belong to the same species. This is impossible from both the taxonomic and zoogeographical points of view.

It is well known that in two closely related species, a small subspecies of the larger form frequently becomes similar to the large subspecies of the smaller form and vice versa. However, this is no reason to unite species. This would produce only confusion. Fortunately, nobody has as yet considered uniting Sorex araneus L. and S. minutus L., in spite of the fact that both have large and small subspecies. Nor has anyone united Pipistrellus nathusii and Pipistrellus pipistrellus in spite of the existence of intermediate types of tooth structure. Even the expert and supporter of the specific cycle (Formenkreis), O. Kleinschmidt (Die Formenkreislehre, Halle, 1926, S. 46-49), rejected the suggestion that Passer domesticus and Passer hispaniolensis be united in spite of the existence of transitional forms.

All this shows how careful one should be before reducing species; "simplification" may lead only to errors and confusion.

25 GEOGRAPHICAL DISTRIBUTION. Ochotona alpina Pall. is widely distributed in the Altai Mountains. The type specimens were caught by Pallas in the Tigiretskii Range, and also on Sinyaya Sopka on the Kolyvan river. According to Pallas (1773) it is found in very large numbers in this place. A.M. Nikol'skii (1884) found a pika between Kuegan and Tourak, i.e., in the northern part of the central Altai, and also near Uimon (in the southern part of the central Altai). According to A.M. Nikol'skii many black specimens are found in the latter locality. N.F. Kashchenko (1899) recorded pikas from the following places: vicinity of the village of Shebalino; Tuekta in the Ursul' Valley (central Altai); along the Malaya Ul'chumen' river in the upper reaches of the Katun river; near the village of Kotandy; in the vicinity of Lake Ten'ga; in the vicinity of the village of Chergi; on the Ongudai (partly in central Altai, and partly in the northern part of the central Altai). I found pikas from the following places in the collection of the Tomsk University: vicinity of Tuekta (Tuekhta); upper reaches of the Katun river (coll. Prof. Sapozhnikov); Malo-Ul'gumenskie snow-covered peak; Kotandinskaya mountain-steppe. O. Thomas (1924) examined specimens from the following places: vicinity of Berel (southeastern Altai); the Chulyshman river (from Ust'-Bashkaus). Prof. N.F. Kashchenko (1902) found the Altai pika in the following places: Chulyshman river (near Tartychai); Bele Plot on the eastern coast of Teletskoe Lake. A large series of Altai pikas were caught near the Teletskoe Lake by the expedition of S.S. Turov and A.M. Kolosov. I have examined specimens from their collection from the mountains adjoining Teletskoe Lake (near the sources of Teletskoe Lake in the Biya river), from

Altyn-Tu, from Dzhulu-Kul' etc. Satisfactory material from the Altai Reserve has been sent to the Moscow State Museum.

B.S. Vinogradov (1924) has specimens from the northwestern Altai, and from screes in the vicinity of Ridder [Leninogorsk]. B.A. Kuznetsov (1932) obtained many pikas in the following places: the alpine-meadow region; the Sarym Mountains; the upper reaches of the Sarymsak river (in the Narym Mountains of southern Altai). I have a representative series of pikas from the mountains adjoining Katon-Karagai (Altaiskaya village) collected by V.I. Dotsenko. Pikas were caught in the extreme southeastern corner of Altai, near Chegan-Burgazy in the Chuya Alps. A specimen caught in this region was used by N. Hollister (1913) as holotype for his species Ochotona nitida. A.M. Kolosov obtained a good series on the Chuya Alps near Chegan-Burgazy.

The range of Ochotona alpina in the Altai includes the northwestern and northern Altai, and the entire southern and southeastern Altai. This species is thus very widely distributed in this area. According to P.S. Vinogradov (1933), this species is distributed in northwestern Mongolia (on the Hangay Mountains). I have seen specimens from the Hangay Mountains in the ZMAN collection (collected by P.K. Kozlov, 1924).

Ochotona alpina certainly occurs in the Sayan Mountains, where it was first recorded by G. Radde (1862). B.S. Vinogradov (1927) found O. alpina in the mountains near the estuary of the Kazyr-Suk river. According to B.S. Vinogradov and S.I. Obolenskii (1927) this species is found in the Minusinsk and Krasnoyarsk areas. He reports that the local
26 pikas are related to the Altai species, although they are smaller. According to M.D. Zverev (1930) pikas are found in the mountain steppes of the southern parts of the Minusinsk and Khakassian districts.

In Transbaikalia, O. alpina occurs on the eastern coast of Lake Baikal, and on the Barguzin Range (O. alpina svatoshi, S.S. Turov, Doklady Akademii Nauk, 1924, p. 110). I found a good series of O. alpina svatoshi in the material collected by S.S. Turov in the Barguzin Reserve (Sosnovka District) and in that collected by N.V. Nekipelov on the Bol'shoi Cheremshan and the Barguzin Range. We have, unfortunately, no accurate data on the distribution of O. alpina svatoshi in Transbaikalia, especially in its northern part. According to V.N. Skalon (1936, in litt.), O. a. svatoshi reaches the Trans-Kamensk District in the south and Chita in the east.

O. alpina was first recorded from eastern Transbaikalia by L.V. Schrenck (1858). He identified material collected by R. Maak from the upper reaches of the Amur as O. hyperborea var. cinereofusca. B.A. Kuznetsov (1929) found this species, which he considered to belong to species alpina (subsp. cinereofusca) in the Udinskii Range. V.N. Skalon (1936, loc. cit.) thinks that O. alpina cinereofusca is distributed along the upper reaches of the Amur, in the Udinskii Range, reaching at least the upper reaches of the Gazimur river in the south. The steppe and forest-steppe regions of the eastern Transbaikal Ranges are inhabited by a peculiar form of the Altai pika, which was described by V.N. Skalon (1935) as separate subspecies, O. a. scorodumovi. It is found in the Kailastui District, near the Aleksandrovskii Zavod, to the north and west of the Borzya District, and south of the Gazimur river. It is not exactly known how far east the range of O. alpina extends. O. Thomas (1909) identified the Ussurian pikas as O. cinereofusca.

This identification is, however, doubtful. A pika of the group hyperborea (O. h. mantchurica Thos.) occurs on the Great Khingan Mountains. B. Howell (1928) described the race O. alpina argentata from northern Kansu. If this race indeed belongs to O. alpina, the eastern range of this species thus reaches southeast to North China. As already stated, the range of O. alpina in the east of the upper reaches of the Amur and to the southeast of Transbaikalia is unknown.

MODE OF LIFE. HABITATS. Screes are the typical habitat of the Altai pika. B.S. Vinogradov (1924) observed pikas in such places in the vicinity of Ridder.

A detailed description of the habitats of O. alpina is given by Prof. N. F. Kashchenko "Rezul'taty Altaiskoi zoologicheskoi ekspeditsii, (Results of a Zoological Expedition to the Altai) 1899, pp. 51-56: "Pikas are widely distributed on the Altai. They apparently occur wherever suitable screes are available. They choose only screes with stones about 1/2 - 1 m large. Pikas occur also in screes of larger stones, though less often. They never occur in screes of small stones, apparently because there is insufficient space between the stones.

27 "Screes inhabited by pikas can be divided into 3 types according to their origin. To the first type belong stones breaking from rocks as a result of disintegration. Such fragments accumulate in hollows between rocks, are completely devoid of vegetation and consist of several layers. Screes of this kind rarely occur in easily accessible, flat or gradually sloping localities. They are usually found at greater heights and on steep slopes. Stones are easily displaced and rolled if one walks on them. We found many such screes near Ongudai on 17 and 18 June. Many of them consisted of small stones. We found pikas only near maral farms of Messrs. Varvinskii and Makar'ev 7 versts* from the village, in a high and little accessible hollow between rocks.

"The second type of screes is represented by rounded mountain peaks which are sometimes completely covered with rock debris. These screes are sparsely overgrown with low birch and a few other plants of the alpine tundra. These were apparently rocks which were transformed to such a large broken area during many thousands of years. We found pikas (25 June) in screes higher than the snow which was not continuous but formed patches on the Malo-Ul'gumenskie snow-covered peak.

"To the third type of screes belong formations which are very similar to screes as far as the life of pikas is concerned, namely, man-made structures. In many valleys in the Altai, especially along the river Urusul, there are ancient tombs (tumuli) made of unhewn stone in various stages of ruin: some of them are almost worn to the ground, others are still high. Most of the tombs have the shape of a ring, with a central hollow open to the ground or even deeper. These hollows, which may not be much more recent than the tombs themselves, were probably made by grave-robbers. Pikas settle in these remnants of man's past glory, but they choose only tombs constructed of sufficiently large stones."

B. A. Kuznetsov found many pikas in high-mountain screes in the southern Altai (Narym Range). He describes vividly his first encounter with this peculiar rodent: "We were climbing in a small winding caravan towards the Sarym mountain path to Lake Marka-Kul. We left the wooded taiga far below us. The last cedars had disappeared. In the gray mist of the cloud around us we saw the enormous bulks of the wild cliffs, separated by hollows filled with deep firn. Here and there alpine meadows stretched on the southern slopes, on which creeping juniper and dwarf birch alternated with areas covered with a lush carpet of various high-mountain grasses and flowers. Silence reigned everywhere, such as only exists on snow covered mountains. Suddenly, a peculiar shrill whistle from a very close 28 scree cut through the fog. I looked a long time for the source of this whistle, but in vain. The screes seemed completely desolate. Suddenly the muzzle of a small animal with black gleaming eyes and large rounded ears looked out from under a huge overhanging slab of limestone. Then the animal jumped out and settled on a nearby block, scrutinizing with astonishment men who are so rare here. It was a pika!"*

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* [Verst: 1.067 km.]

In the southern region of the Teletskoe Lake A.M. Kolosov (1933) found pikas not only in their typical habitat, screes, but also in other habitats such as dense mixed forests with rich *Spirea* overgrowth (at 1500 to 1800 m altitude). On another occasion pikas were found above the forest zone (at about 2000 m) in arid, sunny, *Artemisia* and *Festuca* regions. It is of interest that pikas were found in the high-mountain alpine tundra, in the vicinity of Lake Dzhulu-Kul' (near the sources of the Chulyshman river). According to A.M. Kolosov, pikas in this region inhabit moraines which are surrounded with bogs and thickets of polar birch.

Altai pikas persistently inhabit screes even when their external appearance is completely changed. N.A. Avrorin ("Materialy o tipakh lesov gornogo Altaya" (Forest Types of the Altai Mountains).—Trudy Instituta po izucheniyu lesa, Akademiya Nauk, issue I, 1933) recently described the formation of screes as follows: screes result at first from eolian disintegration of rocks. Such "young" and energetically-growing screes are mobile and overgrown only with lichens. Neither mosses nor flowering plants can exist in them. In the second stages the screes become "quiescent", the stones losing their mobility. Such screes are covered with moss and some flowering plants (*Sedum hybridum*). Disintegrating rock particles reach the lower margin of the scree more rarely and vegetation is thus more intensive there. The following plants can be found at the periphery of the screes: currant (*Ribes nigrum*, *R. atropurpureum*), gooseberry (*Ribes grossularia*), very fragrant and sweet raspberry (*Rubus melanolasius*) etc.

Later, screes become densely overgrown with *Caragana arborescens*, *Lonicera coerulea*, *L. microphylla*, *Spiraea chamaedryfolia*, *Berberis sibirica* etc. The afforestation of the "old" scree takes place under the shelter of these shrubs.

According to A.M. Kolosov, pikas do not leave screes, even when screes of the first type become gradually transformed into mountain forest regions. V.V. Dmitriev kindly placed his interesting observations on the life of pikas in such changing habitats at my disposal. He found large pika colonies on the eastern coast of Lake Ity-Kul' in the upper reaches of the Chul'cha river (a tributary of the Chulyshman river), and also in the upper

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* B.A. Kuznetsov, Gryzuny Semipalatinskogo okruga (Rodents of the Semipalatinsk District). — Byulleten' Moskovskogo obshchestva ispytatelei prirody, 51 (1—2):115-116. 1932.

reaches of the Bidui river (a right-hand tributary of the Abakan river). The screes have here completely lost their primitive character: alluvial soil is never found, and stones and rocks are covered with moss. The pikas hide in
29 burrows. The exits of the burrows are covered with green moss. Large cedar groves interspersed with spruce grow on such changed screes. The screes are on the northern slopes of the mountains. The ground is covered with a thick layer of green moss and thickets of wild rosemary and round-leaved birch. Food stores of pikas here consist only of wild rosemary and birch leaves. Only rarely do they include some Calamagrostis grasses, which grow very scantily here.

In the Altai mountains pikas inhabit heights of from 400-500 m to 2500 m.

GENERAL DESCRIPTION AND HABITS. In places where pikas do not (or only rarely) meet man, and where they are not hunted, they are not timid and often permit close approach. When the animal is frightened it looks out of its burrow slowly and very cautiously, puts out its head, looks around, and hides again among the stones. V.N. Skalon (in litt. 1936), who found pikas in eastern Transbaikalia, in the Baiolga ravine, reports that Ochotona alpina cinereofusca is rather timid. "On seeing man the animal either hides without movement, or whistles (though not as shrilly as O. alpina*) and disappears in its burrow. If one sits motionlessly the animal will soon reappear. It comes out of its burrow, looks around and goes about its business".

Its voice is a strident, sharp whistle. The movements of the pika are rapid but not as quick and graceful as those of hares. Compared with them, the gait of these short-legged animals is a clumsy waddle.

DAILY ACTIVITY. According to B.A. Kuznetsov (1932), the activity of pikas starts at daybreak and ends at dusk. Their whistles are sometimes heard even at night.

According to A.M. Kolosov's observations in the Teletskoe Lake region, the pikas are heard in the morning from 9 a.m., when the ground has already become heated.

According to V.N. Skalon (in litt., 1936) O. a. cinereofusca does not leave its underground shelters at definite hours. Its activity is not strictly confined to definite hours. Altai pikas are usually active from daybreak until the strong heat begins, and then again from 4-5 p.m. until sunset.

V.N. Skalon frequently saw O. a. cinereofusca at noon. He thinks that the irregularity of their daily activity may be partly due to the fact that they usually inhabit deep narrow ravines where the sun's rays hardly penetrate.

BURROWS, FOOD AND FOOD STORES. The burrows of Altai pikas are usually built in screes between stones. Food is stored in typical "stacks" near the burrows, often under stones. Food is also hoarded deep inside the
30 burrows. B.A. Kuznetsov (1932) reports the following: "In August, when I collected material on the snow-covered Narym Mountains, I observed that the pikas were busy preparing hay for the winter. In the morning they could be observed scurrying among the stones of the scree carrying grasses to their nests. I found large stores of dried hay between the stones, solidly rammed into cracks. These hoards consisted of many different plants, but cereals were not represented in them at all".

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* V.N. Skalon apparently means the typical Altai form.

V.N. Skalon (in litt. 1936) describes food collection by pikas as follows: "The pika moves slowly, its movements like those of a calmly feeding rabbit. It examines the ground, paying particular attention to the yellow birch leaves which cover it. A suitable leaf is taken at the edge and borne to the burrow. The pika repeats this several times, and discards dozens of unsuitable leaves. When it becomes tired and hungry it chooses a leaf, calmly sits down and eats rapidly, moving its muzzle like a rabbit."

V.N. Skalon adds: "Food-hoarding pikas do not only drag leaves into the burrow. They also store leaves on the ground, apparently using leaves driven by the wind under fallen trees."

A.M. Kolosov (1933) found the following plants in food stores of pikas in the Teletskoe Lake region on the Altai: *Rubus idaeus*, *Rosa acicularis*, *Athyrium filix femina*, *Pteridium aquilinum*, *Saxifraga crassifolia*, *Lycopodium annotinum*, *Vaccinium vitis idaea*, *Betula verrucosa*, *Sphagnum*, *Archangelica descerrens*, *Cystopterus fragilis*, *Carex* sp.

A.M. Kolosov found many pika bite-marks on shrubs. In some cases finger-thick twigs had been gnawed. He assumes that pikas sharpen their teeth on such twigs.

REPRODUCTION. We know very little on the reproduction of alpine pikas. No data on this subject have been published. The collection of pikas made by A.M. Kolosov in 1936 contains a series of young specimens which are two-thirds as long as adults (caught in the first ten days of July). The dates and number of litters per year are unknown.

B.A. Kuznetsov (1929) states that *O. a. cinereofusca* has at least two litters per year.

Kuznetsov writes as follows: "Working on the Udinskii Range in late June, I saw young pikas of the first litter (16-17 cm long) already living in separate burrows. At the same time, young of the second litter were still suckled, only occasionally coming out of the burrows to get warm in the sun. They were the size of a vole. A litter apparently consists of 4-6 specimens".

Our knowledge of molts is also very incomplete. Examination of
31 material from collections gave the following conclusions. Molting into summer fur begins between May and June. Males molt earlier than females. Molting is delayed in females, apparently in connection with gestation. Some males have almost finished their molting by the first half of July. The spring-summer molt takes place in a definite sequence. The flanks, head and front part of the back molt first, and the posterior part of the back later. There is one female specimen in my collection (No. M. 3979) caught at an altitude of 2300 m, near Katon-Karagai on 6 July 1931, still bearing her complete warm winter fur. Beginnings of molting were observed in some females caught in late July and early August. Molting in females normally starts in late July (e.g., No. 240 ♀, 27 Jul. 1936 Kuraiskaya Steppe, Altai, A.M. Kolosov) or in early August (No. 2358♀, 13 Aug. 1929. Katon-Karagai, B.A. Kuznetsov).

The replacement of the short gray fur of half-grown specimens by the adult rust-colored fur takes place in August-September, sometimes beginning even earlier, in late July. The fur of the flanks, cheeks and anterior part of head is shed first, and then that of the back. The fur of the nape is the last to be shed in some specimens.

Winter fur is substituted for summer fur in late September and October in adults. Specimens caught in late November and December had already completed their molt and bore full winter fur.

In yearlings which had recently assumed their adult summer coat (August-September), molt and growth of winter fur set in rapidly. This process was not found in these yearlings. It is, however, probable that the full molt into winter fur closely follows the early fall molt in which the young assume their adult fur. The process is therefore almost continuous.

This subject is very interesting and should be further studied on a large amount of material.

These pikas do not hibernate.

ECTOPARASITES. A.M. Kolosov (1933) states that a small parasitic tick which lays many eggs is very common on the ears of O. alpina. The frequent scratching of the ears with a hind paw observed in them is apparently due to the itching caused by these parasites.

E.N. Pavlovskii (in "Zveri Tadzhikistana" (Animals of Tadzhikistan). pp. 54-55, 1935) writes that the skin of O. alpina is parasitized by larvae of Oestromyia pallasii. He gives a good drawing of these larvae in a section of the body wall of the Altai pika (Figure 23, p. 54)

Subspecies of Altai or Alpine pika

309. Ochotona (Pika) alpina alpina Pall. (1773). Central Altai pika

1773. Lepus alpinus Pallas P. S., Reise durch verschiedene Provinzen des Russischen Reichs, II, S. 569, 701.

1778. Lepus alpinus Pallas P. S., Novae species Quadrupedum e Glirium ordine, p. 45-59.

1811. Lepus alpinus Pallas P. S., Zoographia Rosso-Asiatica, p. 150.

32 1842. Lagomys ater Eversmann E., Addenda ad celeberrimi Pallasii Zoograph. Rosso-Asiatica, p. 3 (type from vicinity of Uimon).

1899. Lagomys alpinus Kashchenko, N. F., Rezul'taty Altaiskoi ekspeditsii (Results of an Expedition to the Altai), pp. 54-57.

1924. Ochotona alpina Vinogradov B. S., Nablyudeniya nad gryzunami Zapadnoi Sibiri (Observations on Rodents of West Siberia), Izvestiya Sibirskogo entomologicheskogo byuro, No. 3, p. 36.

1932. Ochotona alpina Kuznetsov B. A., Gryzuny Semipalatinskogo okruga Kazakhstana (Rodents of the Semipalatinsk District of Kazakhstan), Byulleten' Moskovskogo obshchestva ispytatelei prirody, XII (1-2):115-116.

TYPE LOCALITY. Vicinity of Tigiretskoe in the Tigiretskie Mountains of Northwestern Altai. Type unknown.

MATERIAL EXAMINED: 42 pelts (most of them with skulls).

DIAGNOSIS. Skull large, length in adult specimens 47-57 mm (M. 50.2); condylobasal length 44-53 mm (M. 46.8); zygomatic width 22-26 mm (M. 23.6); width of skull at level of auditory meatus 22-25.7 mm (M. 23.6).

Color of summer fur on back in adult specimens dull yellow-ocher-gray (tawny-olive), darkened by black or very dark brown hair tips. Flanks with marked rust-red tinge (pinkish cinnamon); belly pale, yellow-ocher (pinkish cinnamon to cinnamon-buff).

Winter fur dirty-ash-gray with marked black tinge caused by very dark brown hair tips. Lower part of back usually with rusty tinge. Belly dull dirty-grayish with a marked rusty tinge.

The general gray tone of the back in the winter fur of some specimens is mixed with dull brown (sayal-brown and snuff-brown). Flanks and belly of such specimens with marked ocher tinge*.

SYSTEMATIC NOTES. There are no pelts and skulls from the type locality of Ochotona alpina, namely the Tigiretskie Mountains, in our zoological museums. I examined pelts from the Ust-Kamenogorsk vicinity (collected by Kinderman, 1853) in the ZMAN collection and also specimens from the vicinity of Ridder [Leninogorsk] i.e., from localities near the typical region of O. alpina Pall.

Their general color is quite bright, and they are distinguishable from the southern Altai specimens from the Narym Range. The northwestern Altai and its central and southern parts are thus apparently inhabited by the typical form.

GEOGRAPHICAL DISTRIBUTION. From the Tigiretskie Mountains in the north to Ust-Kamenogorsk, Ridder [Leninogorsk] in the west, to the Katun river in the east, and the Uimon and Narym Mountains in the south.

310. Ochotona (Pika) alpina nitida Hollist. (1912). East Altai pika

1902. Lagomys alpinus Kashchenko, N. F., Mlekopitayushchie Altaiskoi ekspeditsii Ignatova (Mammals Collected by Ignatov's Expedition to the Altai), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, VII, p. 300.

1912. Ochotona nitida Hollister N., New Mammals from the Highlands of Siberia, Smithson. Miscellan. Collect., Vol. 60, 14, p. 4.

33 1913. Ochotona nitida Hollister N., Mammals Collected by the Smithson. Harvard Exped., Proceedings U. S. National Museum, pp. 522-523.

TYPE LOCALITY AND DEPOSITION. Chegan-Burgazy mountain pass in the upper reaches of the Chuya Alps, southeastern Altai. Type No. 7539 in the collection of the U. S. National Museum.

MATERIAL EXAMINED: 60 pelts with skulls.

DIAGNOSIS. Skull smaller than in the typical race, its length in adult specimens 15-51 mm (M. 47.6); condylobasal length 41-48 mm (M. 43.7); zygomatic width 21.2-24 mm (M. 22.5); width of skull at level of auditory meatus 21.2-23 mm (M. 22.3).

Color of summer fur on back generally dark brown, mikado-brown to snuff-brown; color of summer fur on back even darker, in some specimens intensely chestnut-brown with marked blackness; rust and ocher shades very marked on flanks (sayal-brown and cinnamon). Belly gray-ocher (cinnamon-buff with a strong gray tinge).

SYSTEMATIC NOTES. N. Hollister (1912) described this form from a specimen** from the Chegan-Burgazy mountain pass. He stresses the dark color of the summer fur of O. nitida on the back ("general color of upper parts dark mummy-brown, a mixture of russet and black; nose, cheeks and area behind ear lighter"), and also the smaller size of O nitida as compared with north Altai forms.

O. alpina nitida is certainly well differentiated as a subspecies.

GEOGRAPHICAL DISTRIBUTION. Ochotona nitida lives in the eastern Altai, in the Teletskoe Lake region, along the Chulyshman,

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* Completely black (melanistic) specimens often appear among central Altai pikas, and also among those from the northern and southern Altai.

** Hollister had a series from the Chegan-Burgazy mountain pass and from Tapuchi (31 pelts) in addition to this type.

Chul'ga and Bashkaus rivers, in the upper reaches of the Chuya river (Chegan-Burgazy), reaching the Sayan Mountains in the east.

311. Ochotona (Pika) alpina changaica subsp. nov. Hangay pika

TYPE LOCALITY AND DEPOSITION. Mongolia, Hangay, vicinity of Subur-Hayrhan. Type No. 26, 1925 (24) 14 Aug. 1924, P. K. Kozlov, in the collection of the Zoological Museum of the Academy of Sciences.

MATERIAL EXAMINED. The following specimens were examined in addition to the type: 2) No. 125, 1926 (7) ♂ northern Hangay, basin of the Orhon, 1925, P. K. Kozlov; 3) 20 220 ♀, 8 Jul. 1929, southwestern Hangay, screes in Ohton-Tengri; 4) No. 59 ♀, 19 Jul. 1929 Hangay, rocks along river Bombotu (an eastern tributary of the Buyanta Gol river; 5) No. 26, 1925 (23), 15 Aug. 1924, Subur-Hayrhan Hangay, P. K. Kozlov.

DIAGNOSIS. This subspecies is closely related to the typical alpina, closely resembling a series from the Narym Mountains. Series of O. a. changaica in summer fur paler than typical form; upper surface of light yellowish collar duller than in O. a. alpina. Color of winter fur more grayish white than in nominal race.

Dimensions smaller than in O. a. alpina. Skull length 46-48.9 mm (M. 48); condylobasal length 42.7-45.2 mm (44.3); zygomatic width 22.5-23 mm (M. 22.7); width of skull at level of auditory meatus 22.7-23.2 mm (M. 23).

34 SYSTEMATIC NOTES. This subspecies is closely related to O. a. nitida in its dimensions; it resembles the southern Altai O. a. alpina Pall. in its pale color, though both its summer and winter fur is paler (which is obvious in the series).

GEOGRAPHICAL DISTRIBUTION. Hangay in western Mongolia.

312. Ochotona (Pika) alpina scorodumovi Scalon (1935). Skorodumov's Alpine pika

1935. Ochotona alpina scorodumovi Skalon V. N., Nekotorye zoologicheskie nakhodki v yugo-vostochnom Zabaikal'e (Some Zoological Discoveries in Southeastern Transbaikalia), Sbornik Rabot Protivochumnoi organizatsii Vostochnosibirskogo kraya, Vol. I, pp. 85-87.

1936. Ochotona alpina scorodumovi Skalon V. N. Dal'neishie issledovaniya po sistematike i biologii mlekopitayushchikh (Further Studies on the Taxonomy and Biology of Mammals), Izvestiya Gosudarstvennogo protivochumnogo instituta, Vol. IV, pp. 180-192.

TYPE LOCALITY AND DEPOSITION. Northern Kailastui, Borzya District, Transbaikalia, type No. 25,009 (289) male 14 Sept. 1934, in the collection of the Zoological Museum of the Academy of Sciences.

MATERIAL EXAMINED. I have examined only one specimen of O. A. scorodumovi Scalon. The author of this new subspecies described it from a series of 47 specimens from Kailastui, and gave an additional more detailed description from a new series of 244 specimens.

DIAGNOSIS. V. N. Skalon gives the following diagnosis for O. a. scorodumovi; "Differs from O. a. alpina Pall. by its smaller size (length averaging less than 200 mm). Length of type 189.5 mm, average length of the whole series 182.8 mm; skull large, length of skull of type 46.6 mm, average skull length 46.66 mm; condylobasal width of type 43.8 mm, average 43.5; interorbital width 5.5 mm, average 5.4 mm; zygomatic width of type 21.8 mm, average 22.7 mm; occipital height of type 12.1 mm, average 12.0. Color gray-brown and rust-brown to blackish brown, always with marked streaks of black hair; color never with the rich rust tones of Ochotona alpina alpina Pall. Color of flanks usually different from that of belly and resembling that of back (Figure 9).

ADDITIONAL DESCRIPTION. According to V.N. Skalon, the top of the head and spine of specimens of O. a. scorodumovi were either uniformly colored, or the middle of the spine was darker, especially posteriorly. In some cases the spine is almost completely black with a metallic luster. Color of sides of head lighter, tending toward grayish. Flanks always with a rusty tinge. Belly uniformly colored, as a rule paler and more grayish than the flanks. Ears with a well-marked white margin. Inside of ears grayish, outside almost black.

Young specimens almost mouse-gray.

Melanistic individuals never occur.

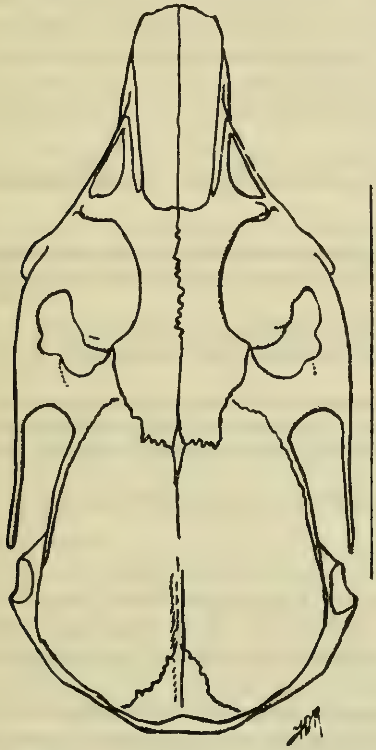

FIGURE 9. Skorodumov's alpine pika, Ochotona alpina scorodumovi Scalon, type No. 25,009, ZMAN collection

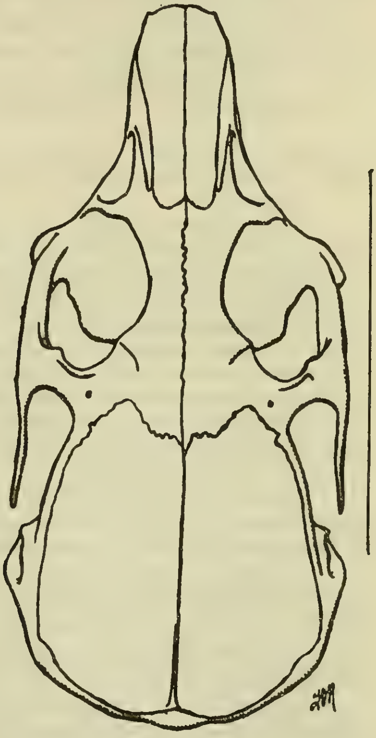

FIGURE 10. Barguzin pika, Ochotona alpina svatoshi Turov, No. M. 3989♀ 19 Aug. 1923, Shumilikha river, Sosnovka, Baikal, S. S. Turov; collection of S. I. Ognev

Drawing by Yu. A. Kostylev

The following is a description of the color of a type of O. scorodumovi from a specimen from the Zoological Museum of the Academy of Sciences. Color dark. General shade of back dark brown with marked blackness caused by the black tips of the guard hairs. Blackness particularly strong
35 on the lower and middle parts of back, less so on top of head. Flanks with marked brownish tones, close to cinnamon; a black tinge is also observed here, but less marked. Belly grayish rust, relatively pale. Muzzle behind eyes and on ears streaked with gray hair which is well marked on basal parts of ears. Chin and upper part of throat grayish.

SYSTEMATIC NOTES. Ochotona a. scorodumovi is most closely related to O. a. cinereofusca; it differs from it by its deeper color with black tones on the back. According to V.N. Skalon, O. a. scorodumovi is also somewhat larger than O. a. cinereofusca. These facts should be carefully verified. On the Gazimur Range, where V.N. Skalon collected his series of O. a. cinereofusca, O. hyperborea mantchurica Thos. also occurs. It may be concluded from measurements of O. a. cinereofusca (published by V.N. Skalon) that he dealt with heterogeneous material. Adult specimens with a skull length of 39.2-42 mm, which appear in the table (No. 10-11), undoubtedly belong to hyperborea.

The only certain difference between O. a. scorodumovi and O. a. cinereofusca is thus the color. It may be more correct to regard
36 O. a. scorodumovi as a natio of cinereofusca.

GEOGRAPHICAL DISTRIBUTION. Borzya District of Transbaikalia.

313. Ochotona (Pika) alpina svatoshi Turov. (1924). Barguzin pika

1923. Lagomys alpinus Turov, S., K voprosu o Barguzinskom sobolinom zapovadnike (The Barguzin Sable Reserve), Izvestiya Vostochnosibirskogo otdeleniya Russkogo geograficheskogo obshchestva, XLI (2):13 (bare peaks along the Burtui river).

1924. Ochotona svatoshi Turov S. S, O faune pozvonochnykh zhivotnykh severo-vostochnogo poberezh'ya oz. Baikala (The Vertebrate Fauna of the Northeastern Coast of Lake Baikal), Doklady Rossiiskoi Akademii Nauk, p. 110 (Barguzin Range).

1929. Ochotona svatoshi Kuznetsov B. A., Gryzuny vostochnogo Zabaikal'ya (Rodents of Eastern Transbaikalia), Izvestiya Assotsiatsii nauchno-issledovatel'skikh institutov, 1 (1): 88-89. Moscow.

1933. Ochotona hyperborea svatoschi Vinogradov B. S., Mlekopitayushchie SSSR (Mammals of the USSR), Gryzuny, p. 83.

TYPE LOCALITY AND DEPOSITION. M 3985, summer 1922, Shumilikha ravine, Sosnovka, Barguzin Reserve. Type in S. I. Ognev's collection.

MATERIAL EXAMINED: 15 pelts and skulls.

DIAGNOSIS. Skull small, length in adult specimens 44-47.2 mm (M. 15.6) [sic]; condylobasal length 40.7-45 mm (M. 42.8); zygomatic width 21.1-22.2 mm (M. 21.6); width of skull at level of auditory meatus 21.2-23.1 mm (M. 22.1).

Summer fur on back of fully grown specimens rich reddish ocher (sayal-brown) with an orange tinge (orange-cinnamon). General color of flanks very slightly different from that of the back. Winter fur reddish ocher with a marked black tinge caused by black tips of the long guard hairs.

Fur of young markedly grayer and duller, generally dull gray-rust-ocher. Sides of body and cheeks with well marked ocher tinge.

SYSTEMATIC NOTES. S.S. Turov (1924) described the Barguzin pika as a separate species. B.A. Kuznetsov ("Gryzuny vostochnogo Zabaikal'ya" (Rodents of Eastern Transbaikalia), pp. 88-89, 1929) confirmed the specific status of O. svatoshi. B.S. Vinogradov (1933) considered O. svatoshi as a subspecies of hyperborea. This form occupies in fact an intermediate position between O. alpina and O. hyperborea. A true, small form of hyperborea occurs in the Transbaikalia mountain taiga. Furthermore, the skull structure and size of svatoshi are more closely related to alpina. It is therefore, more correct to consider O. svatoshi as belonging to alpina.

GEOGRAPHICAL DISTRIBUTION. O. a. svatoshi is found on the Barguzin Range in the Sable Reserve area. Due to lack of material, it is at present impossible to define the northern limit of this form's range, and whether it occurs on the Ikatskii and Yuzhno-Muiskii ranges. V.N. Skalon (in litt. 1936) assumes that it reaches Chita in the east; this is
37 quite possible. It is also unknown how far south this form occurs. An alcohol specimen of Ochotona alpina caught 327 km from Troitskosavsk [Kyakhta] may belong to this form, but I doubt it. This specimen was mentioned by N. F. Kashchenko (1910). A badly preserved specimen (Zoological Museum of the Tomsk University) caught by P. Mikhno in the Aga steppe (Alkhanai bald peak) is closely related to O. a. svatoshi. It is possibly intermediate between O. a. svatoshi and O. a. cinereofusca, to judge by its color. It is however difficult to define the systematic position of this form from a single pelt.

314. Ochotona (Pika) alpina cinereofusca Schrenck (1858). Amur pika

1858. Lagomys hyperboreus var. cinereofusca Schrenck, L., Reisen und Forschungen im Amur-Lande, I, S. 150, Taf. VIII, Fig. 2.

1923. Ochotona hyperborea cinereofusca Soweby, A. de C., The Naturalist in Manchuria, II-III, p. 174.

1929. Ochotona (Pika) cinereofusca Kuznetsov, B. A., Gryzuny vostochnogo Zabaikal'ya (Rodents of Eastern Transbaikalia), Izvestiya Assotsiatsii nauchno-issledovatel'skikh institutov., 2 (1):87-89.

1933. Ochotona hyperborea cinereofusca Vinogradov B. S. Mlekopitayushchie SSSR. Gryzuny (Mammals of the USSR. Rodents) p. 83.

TYPE LOCALITY. Described from a specimen caught by R. Maak in the upper reaches of the Amur river.

MATERIAL EXAMINED: 8 skulls and pelts.

DIAGNOSIS. Skull small, length in adult specimens 44-49 mm (M. 45.8); condylobasal length 40-44.9 mm (M. 42.6); zygomatic width 21-23 mm (M. 21.7); width of skull at level of auditory meatus 21-23 mm (M. 22.2). See Figure 11, p. 27.

General color of summer fur on back dull grayish brown with a slight ocher tinge. This ground color is markedly darkened, especially along middle of back, by black or blackish brown tips of hair; overall color of back intermediate between tawny-olive, sayal-brown and snuff-brown (Ridgway, 1912, pl. XXX). Color of front part of head with distinct gray tones, especially marked in the anterior part of the forehead, on the upper parts of the cheeks, and near the ears. Many blackish brown hairs on the occiput. Flanks dull rust (intermediate between pinkish cinnamon and cinnamon-buff, Ridgway, 1912, pl. XXIX), but more dirty-grayish. Belly lighter and grayer; sides of belly more yellowish.

Winter fur* dirty and dull gray with rich straw-rusty tinge.

Color of young more grayish and dull; it generally resembles the color of young O. a. svatoshi, but is paler and grayer.

SYSTEMATIC NOTES. B. A. Kuznetsov (1929) observed that O. a. cinereofusca and O. a. svatoshi differ from each other as a rule only in color. However, Kuznetsov's opinion that the color of O. a.

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* My knowledge of its color comes only from patches of winter hair retained in the lower part of the back by incompletely molted summer specimens.

cinereofusca is "richer" than that of svatoshi is incorrect. The color of O. a. cinereofusca is duller, grayer and yellower than that of svatoshi, and lacks the intense ocher, reddish, and orange tones characteristic of the summer fur of fully grown svatoshi. These 38 differences can be clearly seen in the series.

V.N. Skalon ("Nekotorye zoologicheskie nakhodki v yugovostochnom Zabaikal'e" (Some Zoological Discoveries in Southeastern Transbaikalia), 1935, p. 85) described a peculiar subspecies, O. a. scorodumovi from near the village of Kailastui (Borzya District). The skull of this form is larger than that of Och. a. cinereofusca according to him (vide supra) the mean skull length of O. a. scorodumovi was 46.45 mm; the skull of specimens from the Baiolga Valley (north of the Gazimur Range) identified by V.N. Skalon as O. a. cinereofusca, is much smaller, its mean length being 42.75 mm. The skull of specimens of O. a. cinereofusca collected by B.A. Kuznetsov on the Udinskii Range is not smaller than that of O. a. scorodumovi; it is even slightly larger (see tables). The Udinskii Range lies north of the Gazimur Range and the Baiolga valley. The cranial differences between O. a. scorodumovi and O. a. cinereofusca should therefore be further studied.

GEOGRAPHICAL DISTRIBUTION. The exact boundaries of the range of this subspecies are not clear. L. Schrenk described cinereofusca from specimens obtained in the upper reaches of the Amur river. B.A. Kuznetsov obtained a series of these pikas from the Udinskii Range south of Nerchinsk. V. N. Skalon recorded cinereofusca from the Baiolga Valley, north of the Gazimur Range.

This subspecies is apparently widely distributed in eastern and northern Transbaikalia, reaching the upper reaches of the Amur river in the east. G. Radde (1862) found a specimen in the upper reaches of the Digan river (in the Bureya Mountains). He notes its relatively large size and considers it a cinereofusca.

O. Thomas (1909) found a specimen of this subspecies in the Ussuri Valley. His observations should, however, be verified.

150. Ochotona (Pika) hyperborea Pallas (1811). Northern pika

1811. Lepus hyperboreus Pallas P.S., Zoographia Rosso-Asiatica, p. 152.

NAMES: Northern Pika, North-Siberian Pika (English); der Nord-Sibirische Pfeifhase, der nördliche Pfeifhase (German).

LOCAL NAMES. Piskun [squeaker] (Russian, on the Lena river); Kamennaya pishchukha [stone pika] (Russian, on the Amur river); chis (onomatopoetic); khaya-kutuyakh (mountain mouse); tas-kutuyakh (stone mouse) (Yakut); chiptyrra, or chantyrra (Tungus-Evenki); ogotnon (Buryat); pika (Lake Baunt Evenki, Tungus); chipa (Orochi on the Amur); teperkan (Orochi on the Gilyui); piski [squeaks] (Orochi in the Far East).

PRINCIPAL FIGURES: 1) Schrenck L.V., Reisen und Forschungen im Amur Lande, I. 1858, S. 150, Taf. VII, Fig. 1 (Lagomys hyperboreus var. normalis), Taf. VII, Fig. 2 (L. h. var. ferruginea), Taf. VIII, Fig. 1 (L. h. var. cinereoflava); 2) Flerov K.K. Pishchukha severnogo Urala (The North Ural pika), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXVIII, 1927, pp. 138-144, figs. 1-3, pp. 141-142 (entire animal); pl. IV, 1-4, (photograph of skulls).

MATERIAL EXAMINED: 206 pelts (most of them with skulls).

DIAGNOSIS. Skull small, length in old animals usually less than 45 mm, 39 42.5 mm in very large and old individuals. Interorbital space of adult and old specimens flattened and 4.3-5.7 mm wide. Anterior third of nasals without spoon-shaped widening. Lateral contours of posterior part of nasals very slightly narrowing posteriorly (less than in Ochotona alpina), with rounded ends. Frontals without fenestrae. Vomer ventrally covered by the margins of the premaxillaries; palatine and incisor foramina separate. Vibrissae mostly blackish brown, with whitish tips, 42-55 mm long. Soles covered with grayish white brownish or even blackish hair. Ears with very narrow whitish margins.

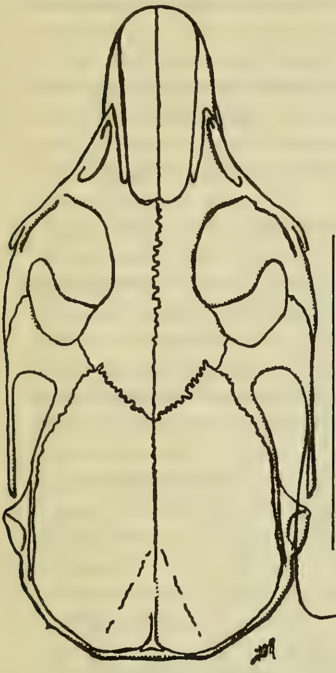

FIGURE 11. Amur pika, Ochotona alpina cinereofusca Schrenk, No. 588 23/VI 1928. Nerchinsk District, B. Kuznetsov
Drawing by Yu. A. Kostylev

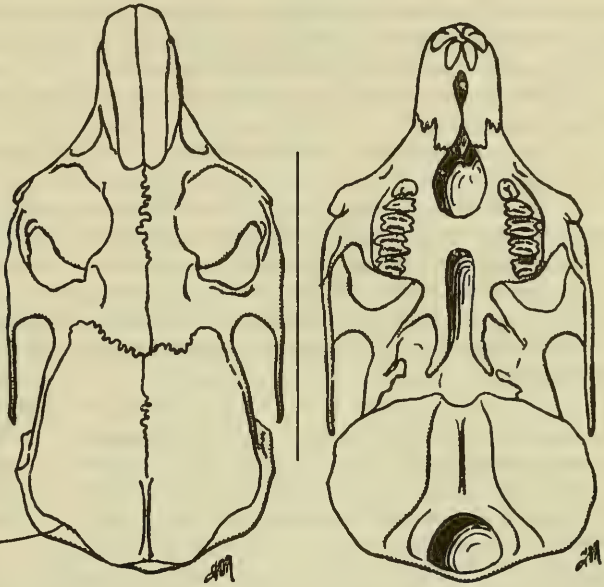

FIGURE 12-13. Skull of Northern pika, Ochotona hyperborea cinereoflava Schrenck. (dorsal and ventral), No. M. 3989 7/III 1928. Ol'skiy Island, Rassvet Bay, G. D. Dul'keit, S. I. Ognev's collection
Drawing by Yu. A. Kostylev

The color of the summer fur varies greatly in different subspecies. The general tone of the back is quite pale in the nominate form, grayish brown with a light straw rusty tinge. Reddish tones (sayal-brown, Ridgway, 1912 pl. XXIX) well marked on lower part of back, upper part of back more straw colored. Flanks darker than back; belly whitish with a distinct straw-yellow tinge.

O. a. cinereoflava has an even paler fur. Its summer fur is distinguished by a rich gray-yellow color with a weak rusty tinge. Flanks rich rust-yellow.
40| O. h. ferruginea has a saturated rust-red-ocher fur, which becomes intense red-rust-brown in the middle of the back. The Amur-Transbaikalian O. h. mantchurica has a relatively dull chestnut-brown fur.

The winter fur differs sharply from the summer fur in its grayer or dirty-grayish color with a brownish tinge.

Color of young which have reached half the size of adults dull gray. Body length may be 210 mm, usually about 150-160 mm; hind foot 30 mm long, usually 26-27 mm or 22-30 mm.

SYSTEMATIC NOTES. O. hyperborea is sytematically very closely related to O. alpina. In B.S. Vinogradov's (1933) opinion the only difference between them is the small size of the former. This is a good criterion, but it does not exclude other specific differences.

The skull of O. hyperborea has many characteristic features (see Figure 12-13, p. 27):

1) Most important is the short rostrum of hyperborea. The distance between the inner margins of the alveoli of the last upper molar is about equal to the length of the upper diastema, measured to the alveoli of the small posterior incisors; in alpina the diastema is much longer than the distance between the alveoli of the molars.

2) The shape of the nasals of hyperborea differs from that of alpina. This can be seen in a series. The width of the nasals is almost equal anteriorly and posteriorly in hyperborea while the nasals of alpina are markedly widened anteriorly.

3) The brain case of O. hyperborea is shorter and more rounded than in alpina.

4) The orbits of O. hyperborea are more rounded, not as elongate as in alpina.

All these differences can be clearly seen in a series. The differentiation between the two species is difficult, because the subspecies of alpina contain some rather small forms, e.g., O. a. svatoshi, O. a. cinereofusca etc. However, the above-mentioned characters, particularly the rostral structure, always determine the species of a specimen.

The following table of measurements may prove useful for general orientation.

	O. alpina		O. hyperborea	
Length of skull	more than	43 mm	less than	43 mm
Condylobasal length	" "	41 "	" "	41 "
Zygomatic width	" "	22 "	" "	22 "
Width of skull at level of auditory meatus	" "	21 "	" "	21 "
Diastema	" "	9 "	" "	9 "
Row of upper molars	" "	8 "	" "	8 "
Body length	usually more than	190 mm	usually less than	190 "
Length of hind foot without claws	" " "	30 "	" " "	30 "
Length of vibrissae	" " "	60 "	" " "	60 "

There are five subspecies of Ochotona hyperborea in the U.S.S.R., which are described below.

41 GEOGRAPHICAL DISTRIBUTION. The Northern pika is widely distributed, mainly in the mountain taiga, in the boreal zone of Asia. Its northern boundary penetrates the tundra, and in the south it occurs in screes, as on the Hangay and in northwestern Mongolia. The range extends roughly between the borders of the Chukot Peninsula in the northeast to the Urals in the west; southern Altai, northwestern Mongolia, Hangay and Manchuria in the south.

Let us now examine the distribution of this species over its wide range in detail.

The Northern pika was first described by Pallas (1811) from the Chukot Peninsula. The "Vega" expedition caught pikas which (O. Nordquist (1883)) identified as the typical form. Specimens from Anadyr are found in the collection of the Zoological Museum of the Academy of Sciences and in my collection (collected by S.V. Kertselli). An excellent series of 27 specimens of the Chukot pika from the vicinity of the village Markovo (on the Anadyr river) and from Cape Dezhnev was obtained by L.A. Portenko during his expeditions to Chukot Peninsula, where this species is widely distributed. L.O. Belopol'skii (in litt. 1936) reports that he found a colony

near Observation Cape (Anadyr Estuary) on a small hill in the talus zone of the bald peaks in the fall of 1930. Similar colonies were recorded near Cape Nerpichiy (Anadyr Estuary) and on hills between the Bay of the Cross and Anadyr Estuary in 1931. Similar colonies were recorded from the valley of the Anadyr river, near the estuary of the Belaya river, near the village of Markovo and in the estuary of the Yeropal river. Further west it occurs on the Kolyma river from where it was described by I.A. Allen (1903). O. kolymensis = O. hyperborea. S.A. Buturlin found burrows and traces of pikas along the beach northeast of the village of Sukharnyi (near the northeastern part of the estuary of the Kolyma river), and frequently heard their voices on Cape Epra-Ukun. He also found pikas in the tundra near the village of Pokhodskii (85 km from Nizhne Kolymsk along the Kolyma river). According to A. Bunge (1887) this species reaches the Yana and Adycha rivers north of 70°N. The collections of the Zoological Museum of the Academy of Sciences contain specimens from the following localities: Verkhoyansk Range; delta of the Lena, valley of the Olenek river; Adycha river. I.D. Cherskii also caught the Northern pika on the Indigirka. O. hyperborea is undoubtedly widely distributed throughout Yakutia. A.I. Ivanov (1934, in "Yakutskaya ASSR" (Yakutian Autonomous Soviet Socialist Republic)) records this species from the following districts: Lena-Khatanga; Lena-Yana; Indigirka-Kolyma. According to R. Maak (1886) it occurs along the middle and lower reaches of the Vilyui river to Suntar. It lives among rock outcrops along the banks of this river 50-60 kilometers above the village of Suntar (K.E. Vorob'eva). According to R. Maak, pikas live among rocks in the upper reaches of the Vilyui river. They were first found by R. Maak on his way to the Olenek river on the Tas plot on the bank of the Khaazngya river. In the collection of the Zoological Museum of the Academy of Sciences are specimens from Yakutiya, from the right bank of the Amga river (opposite the summer camping site of Khokhur-Terde, estuary of the Khokhur river, and from the summer camping site of Ytyk); from the road from the Lena river to Burtul, and from the Eastern Kangalas district. I saw specimens in the ZMAN collection from the following localities in the Verkhoyansk district: Ken-Yuryakh; the bank of the Nel'chekhe river (a tributary of the
42 Adycha river); Tumara river (a tributary of the Aldan river); Nam District (Arbynskii community).

Further south, in the southeastern part of the Lena river basin, it occurs in very large numbers along the Irbo, Choiongro and Yanude rivers, and also along the Yuzhno-Muiskii Range (I. Polyakov, 1873). To the east it is found along the Yablonovoi Range, where B.A. Kuznetsov (1929) caught an excellent series near Kyker. The expedition of B.S. Vinogradov and S.I. Obolenskii (1927) caught a series on the Alkhanai Mountain* south of the Bol'zino railroad station (former Chita Region). Further south it was found in the following localities: Khamar-Daban Range (specimen at the ZMAN collection); near the village of Gazimurski Zavod (S.I. Ognev's collection); the mountains in the vicinity of Okonon (Yablonovoi Range). In the east it occurs in the mountains of the Amur river basin. According to G.N. Gassovskii (1927) it is very numerous on the slopes of the Turkuringra and Gilyui ranges. S.I. Obolenskii sent several specimens from the Turkuringra Range to the Zoological Museum of the Academy of

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* A specimen from the Alkhanai mountain labeled by N.F. Kashchenko as Ochotona sp. is also a Northern pika. (Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, vol. 17, 1912 (1913), p. 397-398.)

Sciences. R. Maak (1859) mentioned that it is frequently found on the Shipka river and in the mountains near the estuary of the Argun river. A.A. Emel'yanov (1927) found this species in the region of the Orochis along the banks of the Kop river. According to Middendorf (1867) it is widely distributed on slopes of the Stanovoi Range. It is also found in Kamchatka, and in the collection of the Zoological Museum of the Academy of Sciences are specimens from the Khalzan Mountains. My collection contains specimens from Ol'skii Island (Sea of Okhotsk), and from the coast of Penzhina Bay and the mountains near the village Penzhino. The Northern pika occurs farther into the mountains near the village Udskii Ostrog, and also in the mountains along the lower and middle reaches of the Amur river. In my collection are specimens from the vicinity of De-Kastri Bay. I saw specimens from the Ussuri Valley in the ZMAN collection (collected by V.K. Arsen'ev). N.T. Zolotarev (1936) mentions specimens from the Kolumba river. I have specimens from the Ussuri Territory in my collection. It is apparently common in some localities on the Sikhote-Alin Range. The ZMAN collection has specimens from Sakhalin Island. Dr. Suprumenko (1899) writes that the Northern pika lives on coastal cliffs and also on mountains on the island. One specimen was caught near Cape Aleksandrovskii (Dui-Zhonkier).

The Northern pika occurs in Manchuria, and was found near Tsitsihar (vide infra), and also on the Great Khingan Mountains. Specimens caught by the American expedition 45 miles north of Ulan-Bator were identified by Gl. Allen (1927) as O. h. mantchurica. However, the local specimens are smaller than the real mantchurica and form, apparently, a separate geographical race together with those from the Hentey and Hangay Mts. (Ohton-Tengri) (vide infra).

Let us now describe the distribution of the Northern pika throughout east Siberia, from Transbaikalia and the watershed between the Lena and Yenisei rivers up to the Chukot Peninsula. The distribution in northern Siberia is as follows.

O. hyperborea was found by N.P. Naumov (1934) in the Yenisei Basin in the mountains of the basins of the Lower Tunguska and Stony Tunguska rivers (Ugami trading station, vicinity of Baikit). In my
43 collection are specimens from the Kureika river (caught by F. F. Shillinger). According to N.P. Naumov (1934) it lives along the Kureika and Khatanga (Kotui) rivers. It does not occur north of 71°N along the Khatanga. It is found in the upper reaches of the Volochanka river (near 69°30' N) and in the Norilsk mountains (at the same latitude) (S.I. Orlov, 1930). Along the Yenisei it does not occur north of the Khantaiskii settlement (68°30' N). Further south, was found in the Yenisei Basin by A. Ya. Tugarinov near Krasnoyarsk (the specimen is in the ZMAN collection), and also on the left bank of the Angara river. It was recorded from the river Ana (a tributary of the Abakan river in the western Sayan Mountains in the Minusinsk territory) (vide M.D. Zverev, 1930). The ranges of hyperborea and alpina overlap both in the vicinity of Krasnoyarsk and in the Minusinsk Territory. It has not yet been found on the Altai.

Nobody has found the Northern pika in the Tobolsk Region of western Siberia so far. The discovery of a litter in the upper reaches of the Voikar river (a tributary of the Ob) by V.Yu. Fridolin (1925) was therefore of special interest. K.K. Flerov, who took part in the expedition of the Academy of Sciences to the northern Ural, found pikas on the eastern slope, in the upper reaches of the Synya river (a tributary of the Ob). Specimens were also found in the valley of the Bol'shaya Kharuta river. This record is very interesting and considerably extends the range of this species to the west.

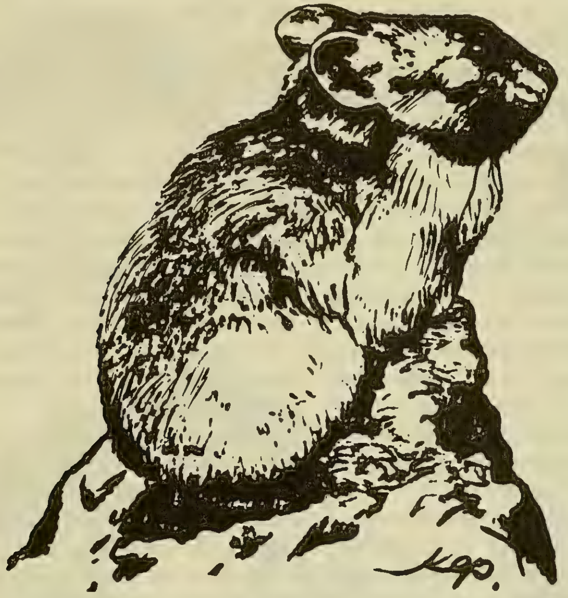

FIGURE 14. Northern pika, Ochotona hyperborea uralensis Flerov

Drawing by K. K. Flerov

MODE OF LIFE. HABITATS. B. A. Kuznetsov (1929) found the Northern pika in Transbaikalia in the vicinity of the Kyker river in the mountain taiga of the main range of the Yablonovoi Range. He states: "This species inhabits screes exclusively. As soon as heaps of debris and detritus are deposited by the torrents of the spring waters, they become inhabited by pikas." N. P. Naumov (1934) reports from the Turukhansk Region: "Pikas occur mainly in screes either at peaks of ranges or in valleys, sometimes close to the water. They are more numerous on screes covered with shrubs, ferns, reindeer moss and other plants. In such places stones are hardly visible, as they are covered by a thin layer of soil. Pikas do not inhabit screes consisting of large, bare stones. However, stony areas are not the only habitat of pikas. I frequently found them in large piles of driftwood along river banks, in which conditions of life are very similar to those in 44 screes. I found a large colony of pikas 7-8 km from the rock outcrops on the bank of the Yenisei river (along its lower reaches, 2 km from Turukhansk). They lived here among old driftwood." K. K. Flerov gives the following interesting data on habitats of pikas on the Urals (1927): "Pikas inhabit all the gabbro screes in the northern Urals. They do not prefer forests or tundra. The deep taiga, shrubs on mountain slopes and bare spaces on peaks are inhabited by pikas to an equal extent. They live only on gabbro, never penetrating the dunite-peridotite massifs, probably because the gabbro screes are rich in cavities which provide many suitable hiding places. The Malyi [Lesser] Ural Range is therefore mainly inhabited by them, as it consists entirely of gabbro. Pikas are the most widely distributed animals in the area; no other animal is as common."

The habitats of this species in Manchuria and on the Great Khingan Mountains are quite unusual. According to A.S. Lukashkin (in litt.) pikas live there mainly in river valleys, along the banks and on small, arid mounds among tussocks. They occur rarely on bare slopes of mud volcanoes. A.S. Lukashkin found them in the floodland of the Nonni [Nun Kiang] river near the Tsitsihar [Angangki] station of Heilungkiang Province, which is an unusual habitat.

In the northern tundra, e.g., in the lower reaches of the Kolyma river, pikas were encountered by S.A. Buturlin in screes (such as near Cape Enra-Ukun, and also among rocks along the right, raised, bank of the Kolyma river). Pikas are also found in the floodlands of the delta of the Kolyma river. S.A. Buturlin often saw pikas in the unflooded parts of the tundra during the spring floods. The animals ran about willow roots across puddles. In the Chukot Peninsula, L.O. Belopol'skii (1936) found colonies in the valley of the Anadyr river in cedar thickets along river banks (such as along the Ust-Belaya) or on slopes and islands covered with weeds and grass (near Markovo and in the estuary of the Yeropol river).

GENERAL DESCRIPTION AND HABITS. The pika is a beautiful, lively animal. Its movements are elegant and it runs and jumps well, and has typical harelike behavior. K.K. Flerov (1927) states that the Ural pikas are extremely agile and alert; it is difficult for eagles and hawks to catch them unawares. At the slightest danger they instantly take to their burrows. He says: "They spend most of the time in their burrows. They emerge at regular intervals, leaping up on a stone and squeaking sharply. One animal's squeak is echoed by others, which sometimes stay inside their burrows and squeak for some time. This chorus then gradually ceases. Pikas normally squeak 15-30 times upon each emergence from the burrow. A frightened animal emits one or two short, shrill, sometimes nearly inaudible squeaks. The sound is sharp, shrill and ringing, resembling the call of the woodpecker. In order to "sing", the pika chooses a stone, usually the highest, which affords a full view of the surroundings. Sight is apparently as well developed as hearing. A person approaching them
45 in the open against the wind is noticed from a great distance, and the pikas flee. The weather does not affect them much. They leave their burrows in rain, cold, and wind but they prefer quiet sunny evenings after the rain."

I can add that the Northern pika does not fear water (like many hares). S.A. Buturlin saw a pika swim across a small stream (about 10 m wide) in the Kolyma delta.

DAILY ACTIVITY. According to K.K. Flerov, pikas of the northern Urals are always awake, their squeaks audible day and night. B.A. Kuznetsov (1929) observed in Transbaikalia that the Northern pika is mainly diurnal, though he heard its squeak repeatedly during the night.

BURROWS AND NESTS. K.K. Flerov (1927) gives a detailed description of nests and burrows of pikas in the northern Urals: "Pikas live in large colonies, but each individual keeps to its own territory, usually one of the small
46 separate screes which cover all slopes. Burrows are dug, and passages run in all directions among the stones with no definite system. Sometimes these passages are open tracks, sometimes they are concealed under stones and covered with earth, like tunnels. The nest is usually constructed among stones, in a crevice or a hollow. Sometimes one animal has several burrows.

True burrows are dug in the forested taiga, among shrubs in river valleys where screes are covered with moss or earth. The passages of these burrows are flat, 9 cm wide and 6 cm high. Burrows are usually small, 1-1.5 m long, without many branches but with several entrances, connected by well trodden paths. The grass on the path is gnawed and removed. The paths usually run in depressions so that the animals are protected. They are 9-10 cm wide. Sometimes there are small open squares at the junction of paths or before entrances. On these squares pikas carry out all sorts of household chores, e.g., they stack the collected food, gnaw off long stalks before carrying them into the burrow, etc. Heaps of excrement may be found at a distance from the entrances, under stones or roots. They are found only rarely on the paths and in the burrows."

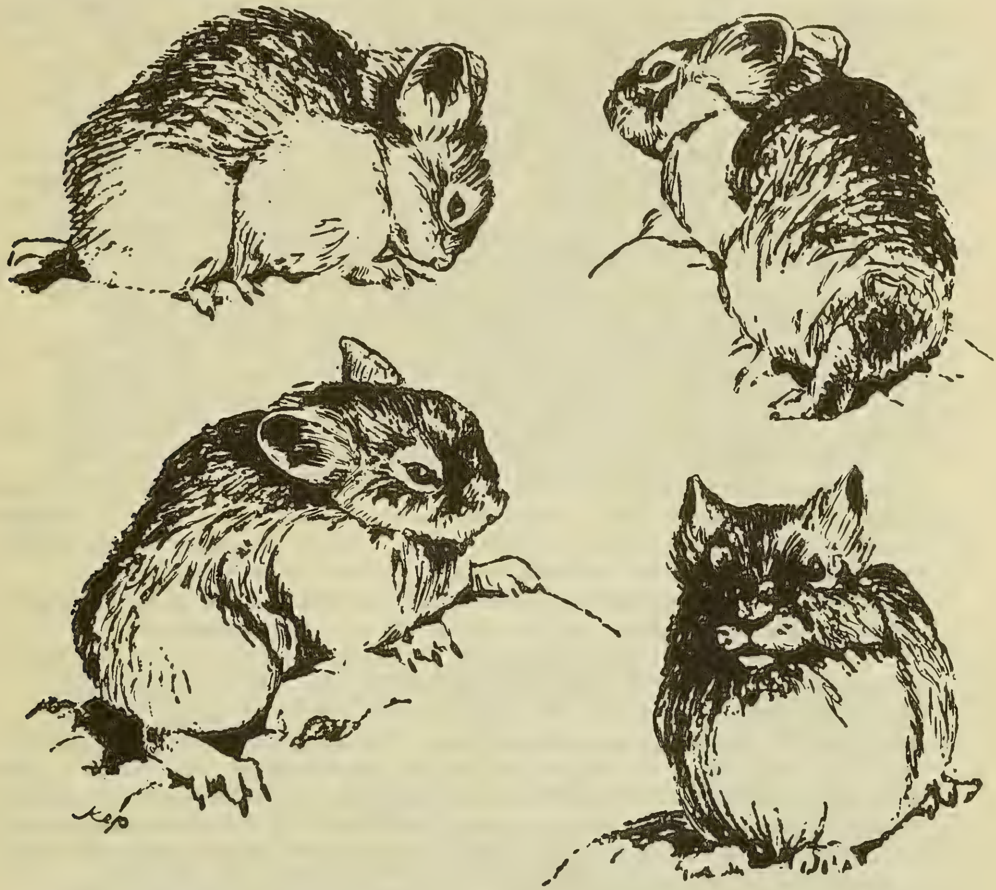

FIGURE 15. Postures of the Ural Northern pika, *Ochotona hyperborea uralensis* Flerov

Drawing by K. K. Flerov

B. A. Kuznetsov (1929) observed the following in Transbaikalia: "In screes consisting of large rocks, pikas usually do not dig burrows, but build their nests of dry grass under the rocks. In screes consisting of small stones where the space between the stones is filled with alluvial soil, they dig deep burrows with several exits." The ecology of the Manchurian pika is apparently quite specialized. A.S. Lukashkin (in litt.) observed that it builds spherical nests of grass under shrubs or on tussocks in summer. More exact information on these habits would be very desirable.

FOOD AND FOOD STORES. The pikas are purely vegetarian. Only once did K.K. Flerov (1927) find remains of spiders in the stomach of a pika. The preferred diet of pikas in the northern Urals is Veratrum lobelianum. They usually cut off the upper part of the stalk. The stalk is cut into pieces 5-10 cm long, and carried to the square in front of the burrows. According to N.P. Naumov (1934) pikas in the Turukhansk territory feed on forest grasses, preferably chickweed (Stellaria). In Transbaikalia (on the Yablonovoi Range) B.A. Kuznetsov (1929) found dry twigs of the following plants in stored food: Filipendula, raspberry, river birch and Vicia cracca. According to I. Safronov (1926) food hoards of pikas in the region of the Ivanovsko-Arakhleiskie farms (Transbaikalia) consisted of twigs of the following plants: birch, larch, aspen, wild rosemary, black crowberry, raspberry and red bilberry. Like all other species of Ochotona, the Northern pika collects food hoards. Such hoards were observed in Transbaikalia by I. Safronov (1926) and B.A. Kuznetsov (1929). N.P. Naumov (1934) observed that in the Turukhansk territory pikas store food by placing small bundles of dry grass under roots of fallen trees, under stones etc. Food is stored at a distance
47 from the passages between burrows. K.K. Flerov remarks that he never saw true "stacks" in the northern Urals. Crevices between stones occasionally contained heaps of dry grass, but there were no large stores. Flerov assumes that large stores are made only in late fall.

REPRODUCTION. According to N.P. Naumov (1934) Northern pikas in Turukhansk territory have their estrus in late May or early June, apparently before the molt, but sometimes at the same time. A male caught on 8 June 1930 on the Tura (Lower Tunguska) still wore its winter fur, but molt was at its height (the fur fell out in tufts). The testes of this specimen were much enlarged. According to observations in Transbaikalia, B.A. Kuznetsov (1929), assumes that the Northern pika of the Yablonovoi Range has two summer broods. Three embryos 45-48 mm long were found in the uterus of a female killed on 23 July. At the same time young specimens 14-15 cm long were found. My collection contains some very young specimens, caught by G.D. Dul'keit on Aug. 17, 1928 on Ol'skii island (Sea of Okhotsk).

MOLT. N.P. Naumov describes the molt of the Northern pika as follows: "The spring molt in O. hyperborea occurs very late. A specimen in molt was caught on Jun. 8, 1930. There is a specimen in the ZMAN collection which had just begun its fall molt (caught on Jun. 27, 1928), and a similar specimen caught on Jul. 15, 1927 (Verkhoyansk District). I found completely molted specimens only in July (Jul. 7, Lower Tunguska). The molt takes place in the following sequence. The fur of the neck is shed first. The molted part surrounds the entire neck, later proceeding to the legs. At the same time the eyes become ringed (No. 18658, Jun. 27, 1928, Verkhoyansk, and No. 16733, Jul. 15, 1927, Verkhoyansk district, ZMAN collection). The molt then spreads over the muzzle to the ears, descending from neck to back, sides, and flanks to the buttocks. Occiput and the lower part of the back still bear winter fur (specimen No. 141, 1928, collection No. 255, Aug. 7, 1927, Verkhoyansk District, ZMAN collection). The occiput and lower part of the back molt later. Winter fur remains on the ears and buttocks, which are last to molt. Judging from the material in the ZMAN collection, the fall molt goes in the opposite sequence, beginning in early September."

Examination of specimens from the Anadyr Territory revealed that the fall molt takes various and different sequences. The anterior part of the body, head and shoulders sometimes molt first. Sometimes the lower part of the hind quarters molts at the same time. The back always molts first and the flanks later. Specimens caught in mid- and late August were in the middle of the molt. Pikas caught in mid-September bore an almost complete winter fur; the series from Anadyr, however, contains specimens still bearing summer pelage in October.

The fall molt of females apparently takes place later than that of males.
48 The same was observed in the Alpine pika.

WINTER LIFE. According to N.P. Naumov (1934) burrows of pikas in the Turukhansk territory are covered with snow, and no life is observed on the surface. All data in the literature indicate that the Northern pika does not hibernate. R. Maak (1859) observed in the Amur territory that pikas do not hibernate, coming to the surface of the snow during severe frost. He found a pika at a temperature of -15°. Pikas in the Kolyma-Anadyr Territory also do not hibernate during the winter.

315. Ochotona (Pika) hyperborea hyperborea Pall. (1811). Northern pika

1811. Lepus hyperboreus Pallas P., Zoographia Rosso-Asiatica, p. 152.

1858. Lagomys hyperboreus var. normalis Schrenck L., Reisen und Forschungen im Amur Lande, I, S. 148, VII, Fig. 1.

1882. Lagomys litoralis Peters W., Sitzungsb. der Gesellschaft Naturforsch. Freunde zu Berlin, S. 95 (near Aran, on Cape Chukotski).

1883. Lagomys hyperboreus Nordquist O., Anteckninger och studier till Sibirska ishafskustens Däggdjursfauna, S. 83 (Berings Sund).

1903. Ochotona kolymensis Allen J., Report on the Mamm. Collect. in North-East. Siberia, Bull. Amer. Mus. Nat. History, XIX, pp. 154-155. (Upper Kolyma).

1926. Ochotona hyperborea Ognev, S.I., Mlekopitayushchie Severovostochnoi Sibiri (Mammals of Northeastern Siberia), pp. 70-71.

1926. Ochotona kolymensis Ognev, S.I., Loc. cit., pp. 68-70.

1926. Ochotona litoralis Ognev, S.I., Loc. cit., pp. 71-72.

TYPE LOCALITY AND DEPOSITION. The "Zoographia Rosso-Asiatica" gives the following indication: "Plura ejus specimina et pelles e terris Tschuktschicis, ubi hyeme collecta fuerunt". We should therefore consider the Chukot Peninsula as the type locality for the nominal race. It is not known whether the type has been preserved.

MATERIAL EXAMINED: 32 pelts (most of them with skulls).

DIAGNOSIS. General tone of summer fur on back rather light, grayish brown with a slight straw-rusty tinge. Rust tones (sayal-brown) extending to lower part of back. Flanks much lighter and more yellow than back (with a gray tinge). Belly white with straw-yellow tinge.

Winter fur on back uniformly colored, pale, grayish brown with a yellow tinge. Flanks with a purer straw-yellow tone. Belly lighter than flanks.

This subspecies is relatively small. Length of skull 35-40.7 mm (M. 37.3); condylobasal length 32.8-38.3 mm (M. 34.4); zygomatic width 17.3-20.7 mm (M. 18.5): width of skull at level of auditory meatus 17.2-21.3 mm (M. 18.5); length of row of upper molars 6.1-8 mm (M. 6.7). Body length 119-160 mm (M. 140); hind feet 20-23.5 mm (M. 21.8).

ADDITIONAL DESCRIPTION. General tone of back of adult specimens rather light grayish brown with a slight straw-rusty tinge. Rusty tones (sayal-brown, Ridgway, 1912, pl. XXIX) well marked on lower part of back; upper part of back more straw-yellow (buffy-
49 brown, Ridgway, pl. X). Top of head, cheeks and area around eyes with an ash-gray tinge. Flanks much lighter and more yellow than back (cinnamon-buff with a gray tinge). Belly whitish with a distinct straw-yellow tinge (pale pinkish buff and pinkish buff). Feet white.

Anterior inner margin of ears covered with blackish gray hair. Inner surface of ears straw-white; posterior parts of ears dull gray.

Color of summer fur of young specimens paler, and sometimes more reddish than in adults; hair of young specimens shorter and thinner. Young specimens are easily recognized by their short, very soft fur.

WINTER FUR. Top of head and back of adults uniformly colored, pale, grayish brown-yellow. Flanks with distinct, straw-yellow tones with a slight grayish tinge. Belly slightly paler than flanks.

SYSTEMATIC NOTES. O. hyperborea from the Chukot Peninsula is undoubtedly identical with O. litoralis which Peters (1882) described from the Avana river on the Chukot Peninsula. Peters apparently described young specimens bearing fur transitory between the summer and winter fur.

O. kolymensis J. Allen (from Verkhne Kolymsk) is identical with O. hyperborea. The former was described by J. Allen (1903) from two alcohol specimens. The Kolyma pikas do not differ externally from those found on Chukot Peninsula. I had a large series of Chukot pikas and only a few from Kolyma. A comparison of skull measurements of these two forms showed that the maxima of the Kolyma and Chukot specimens are equal, but the skull of the Kolyma form is usually slightly larger. This should be verified on the basis of more material.

GEOGRAPHICAL DISTRIBUTION. The range of pikas on the Chukot Peninsula extends from its northeastern parts to the Kolyma Basin, apparently to the Indigirka Basin. The Verkhoyansk Territory is inhabited by another subspecies.

316. Ochotona (Pika) hyperborea ferruginea Schrenck (1858). Russet Northern Pika

1858. Lagomys hyperboreus var. ferruginea Schrenck L. Reisen und Forschungen im Amur Lande, I, S. 148-149 (South Kamchatka, Khalzan Mountains).

1887. Lagomys alpinus Bunge A., Berichte über die Expedition nach Neusibirisch. Ins., S. 40 (nec Lepus alpinus Pall!).

1922. Lagomys kamtschatica Dybowski B., Arch. Tow. Nauk. Lwowie, III, p. 10 (nomen nudum!)

1934. Ochotona (Pika) hyperborea turuchanensis, Naumov, N. P., Mlekopitayushchie Tungusskogo okruga (Mammals of the Tungus District), Trudy Polyarnoi Komissii Akademii Nauk, Issue 17, pp. 38-42 (Lower Tunguska, Uchami trading station).

TYPE LOCALITY AND DEPOSITION. Kamchatka, Khalzan Mountains. Type at the ZMAN collection.

MATERIAL EXAMINED: 57 pelts (most of them with skulls).

DIAGNOSIS. General color of summer fur on back rich, rust-red-ocher, more intensely red-rust-brown along middle line of back (mikado-brown); black hair tips markedly developed on midline of back, sometimes forming 50 an indistinct blackish stripe on backbone. Top of head with deep chestnut tones. Flanks more yellow-ocher (cinnamon). Belly very pale, reddish ocher-yellow.

Winter fur pale, dirty-yellowish gray (intermediate between drab and buff, with a tinge of deep chestnut); middle line of back slightly darker as a result of development of dark chestnut hair tips. Top of head and nape with rich ash-gray tinge, contrasting to color of back. Flanks rust-red with an olive tinge, intermediate between tawny-olive-clay (Ridgway, 1912, pl. XXIX). Belly dull whitish yellow.

This subspecies is larger than the typical form. Skull length 38-41 mm (M. 40). According to N.P. Naumov (1934), the skull length of O. h. turuchanensis reaches 43.2 mm; condylobasal length 37-38.6 mm (M. 37) (according to Naumov to 40.2 mm); zygomatic width 19.03-21 mm (M. 19.9); width of skull at level of auditory meatus 19-21.2 mm (M. 19.8); length of row of upper molars 7.2-7.3 mm (M. 7.3).

SYSTEMATIC NOTES. The North Siberian pika (with the exception of those in the Kolyma-Anadyr Territory) has a rich, saturated color. L. Schrenck (1858) described the Kamchatka population as a separate richly colored "variation" of ferruginea (according to specimens collected by Voznesenskii). I could not find any difference between the Kamchatka specimens and a series from the Verkhoyansk Range (Olenek river), from Baikit (Lower Tunguska), and also from other adjacent localities in Siberia. They are very similar in coloring.

N.P. Naumov (1934) described a subspecies, Ochotona hyperborea turuchanensis, from specimens from Uchami (Lower Tunguska) and from Baikit (Stony Tunguska). Its color is very similar to that of ferruginea. N.P. Naumov (1934) compares turuchanensis with O. svatoshi and O. h. uralensis, but he omits the Kamchatka ferruginea. This form differs from the typical and other forms in the same characters as turuchanensis.

We regard turuchanensis as synonymous with ferruginea; however, there is very little material on Kamchatka pikas. It is therefore possible that differences between the Kamchatka and continental Ochotona will be found when a large series is examined.

GEOGRAPHICAL DISTRIBUTION. In addition to the Kamchatka pikas, specimens from the following localities belong to this subspecies: coast of Penzhina Bay; Verkhoyansk Range; mountains along the right tributaries of the Aldan river (e.g., on the Tumara river); the Khandyk river (a right tributary of the Alden river); eastern slopes of the Verkhoyansk Range*; the delta of the Lena (the village of Bulun, sent by Romanov to the ZMAN collection); the Olenek river (collected by R. Maak); the Chunya river (100 km from its estuary); Lower and Stony Tunguska. Thus, the richly colored O. h. ferruginea is distributed throughout the northern region of eastern Siberia except in the Kolyma-Anadyr Territory.

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* Specimens from the right bank of the Anga river (a tributary of the Aldan river) belong to this form. The ranges of O. h. ferruginea and O. h. cinereoflava (vide infra) lie very close together here, but the boundaries have not been exactly determined.

51 317. Ochotona (Pika) hyperborea cinereoflava Schrenck (1858). Okhotsk Northern pika

1858. Lagomys hyperboreus var. cinereoflava Schrenck L., Reisen und Forschungen im Amur Lande, I. S. 150, Pl. VIII, fig. 1.

TYPE LOCALITY AND DEPOSITION. No. 689, 18 Feb. 1845, Udskii Ostrog, A. Middendorf. Type in ZMAN collection.

MATERIAL EXAMINED: 26 pelts and skulls.

DIAGNOSIS. General color of summer fur on back rich yellowish gray with a slight rusty tinge. Top of head with dark brown tones, especially marked on the hair tips. Indistinct pale yellow on occiput. Flanks with rich yellowish rusty tones. Belly yellowish with a slight ocher tinge.

Winter fur of back generally yellowish gray with an ocher tinge. Black-brown hair tips little marked, so that the color is rather light. Color of head slightly grayer than back; the ground color is yellowish gray with brown hair tips. Flanks more yellow than back; belly whitish with a light yellowish tinge.

Skull length 40-42 mm (M. 40.8); condylobasal length 37-39.21 mm (M. 38.1); zygomatic width 20-20.7 (M. 20.3); width of skull at level of auditory meatus 19.2-19.6 mm (M. 19.1) [sic]; length of upper tooth row 7.3-7.6 mm (M. 7.4).

SYSTEMATIC NOTES. This subspecies is easily distinguished in series from other subspecies of O. hyperborea by its light yellowish gray color with a slight rusty tinge, and also by the light, pure color of the flanks.

GEOGRAPHICAL DISTRIBUTION. This subspecies was described from a specimen from the vicinity of the Udskii Zavod. In L. Schrenck's opinion (1858) the same form lives along the Maya and Olenek rivers. Richly colored forms of the ferruginea type live in the basin of the Olenek river. I examined a series of 19 specimens of this subspecies in the ZMAN collection from the former Yakutsk District caught in the vicinity of the Yelanskaya station (on the Yakutsk-Irkutsk highway).

The light color of pikas from Ol'skii Island (collected by G. D. Dul'keit) shows that they belong to cinereoflava (these specimens are in my collection). This light-colored form apparently inhabits the central and northern zones of the coast of the Sea of Ochotsk, but the same light colored form occurs in Central Yakutia. The lower Amur basin is inhabited by another form which does not differ from the Transbaikal form.

318. Ochotona (Pika) hyperborea uralensis Flerov (1927). Northern Ural pika

1927. Ochotona hyperborea uralensis Flerov K. K., Pishchukha Severnogo Urala (The Northern Ural pika). - Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXVIII, pp. 138-144, fig. 1-3; pp. 141-142, pl. IV, fig. 1-4.

TYPE LOCALITY AND DEPOSITION. No. 16107 ♀ 10 August 1926, eastern slope of the Ural Range, valley of the Bolshaya Kharuta (Syn'ya river), K. K. Flerov. Type at ZMAN collection.

MATERIAL EXAMINED: 4 pelts with skulls.

52 DIAGNOSIS. General color of summer fur on back yellowish-rust, darkened by blackish brown hair tips*. Top of head with a distinct dark brown tinge; fur on occiput more yellowish. Color of flanks and cheeks rather light, ocher-yellow. Belly pale, ocher-yellowish gray.

Color of young specimens paler and grayer than in adults, without ocher shades.

Skull length 37-39 mm (M. 38); condylobasal length 35.3-36.6 mm (M. 38.1); zygomatic width 18-20 mm (M. 19.3); width of skull at level of auditory meatus 18.8-19.7 mm (M. 19.2); length of upper tooth row 7.1-7.5 mm (M. 7.3).

Body length 167-183 mm (M. 175.5); hind feet 22-27 mm (M. 25).

SYSTEMATIC NOTES. The Northern Ural pika differs clearly from the central and south Siberian pika (vide infra) in the lighter color of its summer fur which lacks the saturated rust-red-ocher tones of ferruginea. According to its general color the Ural pika is closely related to O. h. cinereoflava. But more material is necessary to give an exact description of the Ural pika and its characters as given in K. K. Flerov's work. The small number of syntypes in K. K. Flerov's collection did not make it possible to give a more accurate description of the Ural pika.

GEOGRAPHICAL DISTRIBUTION. K. K. Flerov (1927) found this subspecies on the eastern slope of the northern Ural along the upper reaches of river Synya (a tributary of the Ob) and along the river Lyapin (a tributary of the Sosva). V. Yu. Fridolin (1925) collected a litter along the upper reaches of the Voikara river (a tributary of the Ob).

319. Ochotona (Pika) hyperborea mantchurica Thos. (1909). Central Siberian Northern pika

1859. Lagomys hyperboreus Maak, R., Puteshestvie na Amur (A Journey along the Amur). — St. Petersburg, p. 108.

1862. Lagomys hyperboreus Radde G., Reisen im Süden von Ost-Sibirien, S. 232-233 (partim!).

1873. Lagomys alpinus Polyakov, I., Geograficheskoe rasprostranenie zhivotnykh v yugo-vostochnoi chasti Lenskogo basseina (The Geographical Distribution of Animals in the Southeastern Part of the Lena Basin). — Zapiski Geograficheskogo obshchestva, III, pp. 52-53.

1909. Ochotona hyperborea mantchurica Thomas O., A Collection of Mammals from Northern and Central Manchuria, Ann. and Magaz. Natur. History, ser. 8, pp. 504-505.

1927. Ochotona cinereofusca Vinogradov, B. S. and Obolenskii, S. I., Materialy po faune gryzunov yuzhnoi chasti Eniseiskoi i Irkutskoi Gubernii i Zabaikal'ya (Material on the Fauna of Rodents of the Southern Part of the Yeniseisk and Irkutsk Provinces and Transbaikalia), Izvestiya Sibirskoi stantsii zashchity rastenii, No. 2, p. 15 (taiga regions of Transbaikalia, nec. cinereofusca Schrenck!).

1927. Ochotona hyperborea mantchurica Allen G., Lagomorphs Collect. by the Asiatic Exped., Amer. Mus. Novitates, No. 284, pp. 1-2 (a series of 30 specimens caught 45 miles north of Urga).

1929. Ochotona (Pika) hyperborea Kuznetsov, B. A., Gryzuny vostochnogo Zabaikal'ya (Rodents of Eastern Transbaikalia), Izvestiya Assotsiatsii Nauchno-issledovatel'skikh institutov, 2 (1):86-87.

1930. Ochotona hyperborea Zverev M. D., Obzor gryzunov yuzhnoi chasti Minusinskogo i Khakasskogo okrugov (A Survey of Rodents in the Southern Part of the Minusinsk and Khakassian Districts), Sbornik Srednesibirskogo geograficheskogo obshchestva, p. 85 (River Ana, a tributary of the Abakan, western Sayans).

TYPE LOCALITY AND DEPOSITION: No. 23 ♂, 18 May 1908, Great Khingan, British Museum.

MATERIAL EXAMINED: 87 pelts, mostly with skulls.

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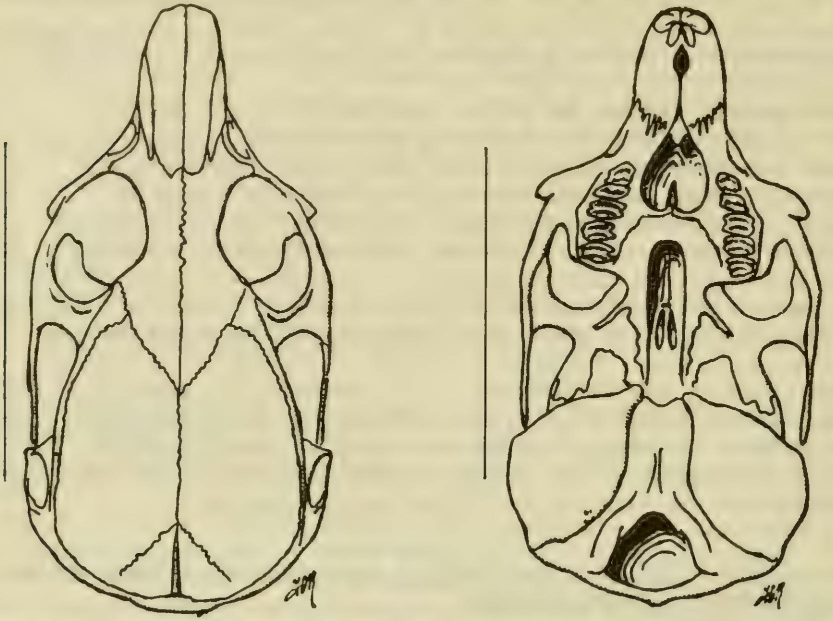
* K. K. Flerov (1927) describes the fur of the Ural pika as "reddish". This seems not as accurate as the description given here.

53 DIAGNOSIS. General color of summer fur on back relatively dark, brown-chestnut, often with a strong development of black hair tips. Flanks rust-brown (cinnamon, Ridgway, pl. XXIX) with a gray tinge. Belly dirty-rust-gray.

Winter fur on back dirty-grayish brown, straw-brownish gray on flanks and dirty-gray with a straw-white tinge on belly.



FIGURES 16, 17. Skull of Central Siberian Northern pika, Ochotona hyperborea mantchurica Thos. 593 ♀ 16 July 1928. Vicinity of Kyker, Sretensk District, Transbaikalia. B. A. Kuznetsov
Drawing by Yu. A. Kostylev

Skull length in fully grown specimens 39.3-43.3 mm (M. 41); condylobasal length 36.7-40.2 mm (M. 38); width of skull at level of auditory meatus 19.2-21.1 mm (M. 20.3); length of upper tooth row 7-8 mm (M. 7.4); body length 150-195 mm (M. 172.8); hind feet 20-30 mm (M. 24.9).

ADDITIONAL DESCRIPTION. It should be added that the color of the summer fur varies in different specimens. In light colored specimens the back generally has a rather intense chestnut-rust-brown color (closely similar to snuff-brown, Ridgway, 1912, pl. XXIX), but has a slight rusty tinge. Top of head of the same color. Color of flanks lighter and purer, 54 with a well marked rusty tinge (intermediate between cinnamon and sayal-brown). Ground color of belly lead-gray with a marked rusty tinge, which is especially marked in the middle of the belly.

Specimens in which the summer fur has strongly developed black hair tips, especially along the midline of the back and on the head, occur together with light colored specimens. These specimens generally have a dark, blackish chestnut-brown fur. Flanks more rusty than back, but also darkened by well marked blackish brown hair tips. Belly lead-gray with a rusty tinge.

Color of winter fur on back more intense than in other subspecies of the Northern pika; its gray ground color is mixed with chestnut-brown.

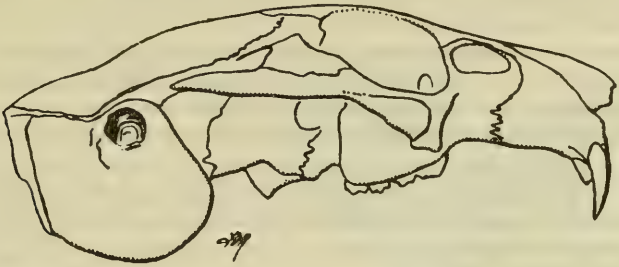


FIGURE 18. Skull of Central Siberian Northern pika, Ochotona hyperborea mantchurica Thos., lateral (same specimen as in Figures 16, 17)

SYSTEMATIC NOTES. O. Thomas (1909) described O. h. mantchurica from 10 summer specimens from the Great Khingan. The color of these specimens was rather pure, without any marked blackish shades. According to Thomas the ground color of this subspecies (summer fur) is intermediate between cinnamon and russet. He also states that the measurements of O. h. mantchurica are generally maximal for the species hyperborea: skull length 43.4 mm; condylobasal length 41 mm, maximum width 22 mm; nasals 14.2 mm long; interorbital distance 4.3 mm; bony palate 15.5 mm long; palatine foramen 6.4 mm; row of upper molars (measured along alveoli) 8.1 mm long.

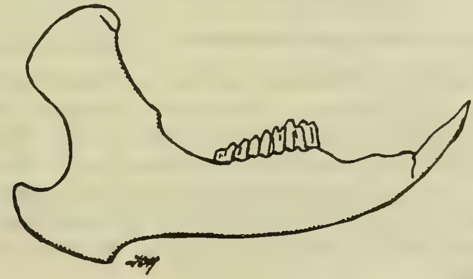


FIGURE 19. Mandibula of Central Siberian Northern pika, Ochotona hyperborea mantchurica Thos., (same specimen as in Figures 16-18)

Body length 178 mm; hind feet 28.5 mm; ear 18 mm.

When I first examined the material I had the impression that O. h. mantchurica differs from Transbaikalian and Amur Northern pikas, and that it is closely related to O. alpina in some characters. After comparing the material I found quite similar specimens from the Yablonovoi Range, Great Khingan, and also from near Krasnoyarsk!

In general, the following tendency was noted. The color becomes deeper, less rich and the animals larger from the north of Siberia (Verkhoyansk

55 Territory, rivers Lena, Yana, Olenek, etc.) southwards. The differences between typical O. h. hyperborea from the eastern parts of the Chukot Peninsula and O. h. mantchurica Thos. from the type locality (Great Khingan) are especially marked. These two forms are antipodal, if their large range is taken into account.

However, these forms have gradual series of intermediate forms like real subspecies. These intermediate forms obliterate the sharp differences between subspecies from far removed localities.

GEOGRAPHICAL DISTRIBUTION. This subspecies occurs in the Yeniseisk Territory, in the taiga near Krasnoyarsk, western Sayans (river Ana, a tributary of the Abakan), near Lake Höbsögöl in the Irkutsk District, the Vitim Olekma upland, Transbaikalia (Yablonovoi Range, Gazimur Mountains), the Amur and Ussuri territories. A.S. Lukashkin (in litt.) reports that this subspecies occurs on the eastern slopes of the Great Khingan (e.g., near the Yalu station of the Chinese Eastern Railway. It was also found in the floodland of the river Nonni [Nun Kiang] near the Tsitsihar [Angangki] Station in the Heilungkiang Province.

G. Allen (1929) received a series of pikas caught 45 miles north of Urga (Ulan-Bator). He identified them as O. h. mantchurica but pointed out that they are smaller. I saw a series of 10 pikas from southwestern Hangay, from Ohton-Tengri in the ZMAN collection. The same collection also has specimens from Hereleng Gol river (eastern Hentey). All these specimens differ from O. h. mantchurica in their light, pure, rust-yellow color similar to that of Central Yakutian and North Ural specimens. It is probable that this is a separate geographical race, which should be carefully studied on a large material.

Subgenus **Ochotona** Link

1795. **Ochotona** Lin, H.F., Beiträge zur Naturgeschichte, I, Abt. II, S. 52, 74.

Skull of most species elongate, slender, arched in the region of the interorbital space and frontals. Fenestrae frontales absent. Interorbital space narrow. Orbits relatively large. Structure of palatine and incisor foramina varying: palatine and incisor foramina in O. daurica, curzoniae, rufescens fused and vomer ventrally free; in O. ladacensis and O. pricei these foramina are separate, and the vomer is ventrally covered by the premaxillaries. Fenestrae triangulares rostri small and rounded.

Color light, straw-sandy, reddish sandy, brownish in summer fur and gray in winter fur. Pads of digits not markedly developed.

Vibrissae short, not more than 60 mm long.

Species of this genus live in open landscapes, steppes, deserts or high plateaus.

Type of subgenus: Ochotona minor = O. daurica Pall.

56 GEOGRAPHICAL DISTRIBUTION. The subgenus occupies a wide range, from central Iran in the west, Iranian Baluchistan, mountainous Turkmenia (Kopet-Dagh), Afghanistan, and further north from the Chuya river to northern and central Mongolia, to the Daurian steppes. The range of the subgenus also includes Ladakh, Nepal, Sikkim, Seistan and Tibet.

Ochotona curzoniae Hodgson, O. ladacensis Günther, O. rufescens Gray, O. pricei Thos. also belong to this subgenus.

151. Ochotona (Ochotona) daurica Pall. (1776). Daurian pika

1776. Lepus dauuricus Pallas P., Reise durch verschiedene Provinzen des Russischen Reichs, III, S. 692.

NAMES: Daurian pika (English); Otogono or Ogotona (German).

LOCAL NAMES: pishchukha-senokoska [hay-cutting pika]; kuyun; "kamennaya koshka" [stone cat]; "kamennyi krot" [stone mole]; ogotona (Transbaikalian Cossacks); ogotona (Mongolian); Umuki (Evenki, Tungus).

PRINCIPAL FIGURES: 1) Pallas P. S. Novae species Quadrupedum e Glirium ordine, 1778, pp. 59-70, tab. III (whole animal), tab. IV A, fig. 16 A and 16 B (skull front and lateral); 2) Schreber I. Ch., Die Säugethiere, Erlangen, IV, 1792, S. 915-918, Tab. CCXXXIX (in color); 3) Simashko Yu., Russkaya fauna (Russian Fauna), Vol. II, Mlekopitayushchie, 1851, pp. 793-794, pl. 63, fig. 3 (in color); 4) Bikhner, E. A. Nauchnye resul'taty puteshestvii N. M. Przheval'skogo (Scientific Results of N. M. Przheval'skii's Journeys), otdel Zoologicheskii, Vol. I, Mlekopitayushchie, Issue 5, 1894, pl. XXV, fig. 1-5 (photograph of skull), pl. XXII (whole animal in color); 5) Kobel't V., Geograficheskoe rasprostranenie zhivotnykh (Geographical Distribution of Animals), 1903, p. 209 (whole animal, half tone plate); 6) Brehm's Tierleben, Saugetiere, II, 1914, Taf. S. 15 (color plate); 7) Formozov, A. N., Mlekopitayushchie severnoi Mongolii (Mammals of Northern Mongolia), 1929, p. 85, fig. 13 (head), p. 86, fig. 14 (skull ventrally); 8) Vinogradov B. S., Mlekopitayushchie SSSR (Mammals of the U. S. S. R.), I, 1933, p. 81, fig. 74 (B) (skull dorsal), pl. VIII, fig. XV (photograph of entire animal).

MATERIAL EXAMINED: 47 pelts, mostly with skulls.

DIAGNOSIS. Skull rather large, its length exceeds 40 mm in fully grown specimens. Interorbital space narrow, 3.2-4.2 mm; surface of interorbital space convex, with two weakly marked converging crests in the middle of interorbital space in old specimens. Nasals slightly widened anteriorly, without constriction at the base of the wider part. Lateral contours of nasals narrowing posteriorly, their posterior ends rounded. Frontals without fenestrae frontales (vide Figure 20).

Vomer completely free ventrally, not covered by premaxillaries; palatine and incisor foramina fused (Figure 22).

Most vibrissae white, a few with a black-brown tinge, 40-55 mm long. Soles either pure white, or gray or whitish brown. Ears with distinct white borders.

Color of summer fur on back varying in different subspecies from pale, yellowish straw-gray to duller and deeper straw-gray. Flanks light and yellow; belly pure white, hair bases gray.

57 Winter fur differs markedly from summer fur in its long and lighter hair, and gray color with a straw-yellow tinge.

Body length to 195 mm; hind feet 31 mm.

ADDITIONAL DESCRIPTION. In addition to the above-mentioned characters, the orbits are rounded (not oval as in O. rufescens, the skull of which resembles that of daurica); base of triangular fenestrae relatively low, elongate longitudinally.

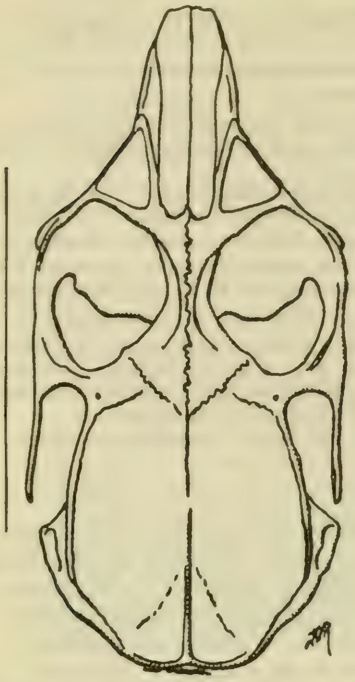
The base of the triangular fenestrae of O. rufescens lies higher, is broader and shortened in the longitudinal direction.

Bullae osseae rounded and slightly flattened laterally. The outer contours of the sides of the bullae are more distinctly flattened in O. rufescens. Rostrum of moderate length, less elongate than in O. rufescens.

The skull structure varies markedly according to age. Rostrum of young skull markedly abbreviated. The distance between the inner margin of the alveoli of the posterior molars is much greater in very young specimens than the length of the upper diastema, as it is in fully grown and old specimens of O. pusilla, in which the lower margins of the premaxillaries are much closer together than in adults of the Daurian pika. In spite of the converging margins of the premaxillaries, the vomer is clearly visible from beneath, completely separate from the margins of the premaxillaries which lie close to it.

The structure of the bony palate is similar in general to that of O. pusilla. The bridge of the bony palate which consists of the pterygoids and palatines is broader than in adults. Bullae osseae more rounded, swollen and short. The brain case is very rounded and short. When skulls of young and adults in profile are compared the parietal bones of the former appear swollen while those of O. pusilla are more flattened and slant posteriorly.

SYSTEMATIC NOTES. The Daurian pika is clearly distinguished from related forms by a number of characters. It includes the following subspecies: the typical subspecies O. d. daurica (from Dauria); O. d. altaina Thos. (vicinity of Lake Achita Nur, to the southeast of the Saylyugem Range in northwestern Mongolia); O. d. bedfordiae Thos. from Shansi (Ningwufu). O. huangensis from Kansu is apparently closely related to O. daurica, and is possibly only a subspecies of this species. The close relation between huangensis and daurica was pointed out by O. Thomas (1908). The description of O. huangensis by P. Matschie (Wissenschaftliche Ergebnisse der Expedition Filchner, Bd. 10, 1908, S. 214-217) is very vague although it seems reliable. The material used by the author was also in bad condition.



58 FIGURE 20. Skull of Daurian pika, Ochotona daurica daurica Pall. No. M.3997 9 June 1925. Near Borzya station of the Chita Railway. E. S. Vinogradov and S. I. Obolenskii, S. I. Ognev's collection
Drawing by Yu. A. Kostylev

GEOGRAPHICAL DISTRIBUTION. N. F. Kashchenko in his "Key to Mammals of the Tomsk Territory" (Opredelitel' mlekopitayushchiksh Tomskogo kraya) (1900, pl. 30) states that O. daurica does not occur in the Tomsk Territory and in West Siberia. In his opinion, Brandt's record of O. daurica in West Siberia is erroneous. The northwestern range of the Daurian pika includes the southeastern corner of West Siberia. This species occurs in the Altai Chuya Alps, where a gray pika was caught in summer 1936 by A. M. Kolosov in the Chegan-Burgazy region. In my collection are several specimens from the Gorno-Altai Autonomous Region caught in the vicinity of Toshakty (1934). All these specimens belong to O. d. altaina Thos. which was described by O. Thomas from specimens from the vicinity of Lake Achita Nur and from Suok (on the Altai). The same author later recorded O. d. altaina from the vicinity of Lake Üreg Nur (north of Achita Nur). There are specimens from Hobdo [Jirgalanta] in the ZMAN collection. A.N. Formozov (1929) recorded the Daurian pika from the vicinity of Lake Orog Nur (45° N) on the eastern slopes of the Great Altai. This species also occurs near Uliassutai [Jibhalanta] on Lake Höbsögöl, inhabiting the valleys of rivers Onshin Gol, Tuin Gol, Baydarag Gol, Dzabhan Gol and the basin of Lake Dzhargalante. G. Allen (1927) mentions that O. daurica occurs south of Ulan-Bator (Urga, near Turin). Apparently, O. daurica is widely distributed throughout northern Mongolia to Lake Dalai-Nor, from where an excellent specimen was sent to me by A. S. Lukashkin. G. Radde (1862) caught a large series near Tarey Nor. R. Maak (1859) recorded it from the steppes of the valley of river Onon and from the vicinity of the Mokhotui frontier post. N. F. Kashchenko (1913) collected a series in the Aga Steppe, and also recorded O. daurica from the former Troitskosavsk [Kyakhta] and Verkhneudinsk [Ulan Ude] counties (1910). B.S. Vinogradov and S.I. Obolenskii (1927) found this species in the vicinity of Troitskosavsk [Kyakhta] and Durena, near the village Mukhor-Shabar. A.N. Formozov (1929) writes that this rodent is so numerous on the Selenga river near Ust-Kyakhta and Troitskosavsk [Kyakhta] that in some places, its fecal pellets are scattered in all depressions of the ground.

Detailed information on the distribution of pikas in Dauria is given in an article by A.S. Fetisov (1936):"The Daurian pika inhabits all the steppes of the so-called Selenga Dauria. This region lies along the valley of the river Selenga. It is found in almost all the steppes and forest steppes of the Selenga and Dzhida regions. The Daurian pika reaches, at present, the river Ulikchin in the west along the Dzhida river. It is not found in the Trans-Kamensk District. This species is frequent near the villages Enkhory and 59 Tsagan-Usun in steppes and forest steppes of the Dzhida Range, and along the Mongolian border. It is very rare in other parts of the Dzhida Range, never reaching the Mongolian border. We caught it only in the estuary of the river Zheltura. It was caught near the middle reaches of the river Khuldat, and it is very common along the left bank of river Dzhida from the estuary to its left tributary Ulikchin. The most northern point in which we found it was near the village Udung (on the left bank of the river Temnik) and in the valley of the middle reaches of the river Armak. In the northeastern region it is found in the vicinity of Gusinoe Lake, the town Novoselenginsk and village Verkhnii Ubukun".

If O. bedfordiae Thomas is considered as identical with O. daurica, the eastern range of O. daurica extends to the Shansi Province in China, but this is still not certain.

N.M. Przheval'skii (E.A. Büchner, Nauchnye rezul'taty, Issue 4, 1890, p. 173) found this species in the southeastern Gobi and Ordos, i.e., the most fertile parts of the Gobi desert. This southern range is apparently not connected directly with the northern range mentioned above.

MODE OF LIFE. Habitats. In the northern part of its range, the Daurian pika lives mainly on high steppes (rarely on firm sands) where it forms large colonies. According to A.N. Formozov (1929), it preferably inhabits ravines and depressions in southern Transbaikalia steppes, rarely mountain meadows (e.g., near Uliassutai [Jibhalanta] on the Höbsögöl). Colonies of O. daurica occur sporadically along river valleys in the semi-steppe and desert. Their favorite habitats are thickets of Iris biglumis and Stipa splendens near water. Small plots with fresh grass are usually found between the scattered hillocks in which the pika builds its burrows. A.N. Formozov adds that: "This species does not avoid the proximity of water, and often settles in damp or very low places. Its burrows become, therefore, completely flooded when the water rises."

B.S. Vinogradov and S.I. Obolenskii (1927) found colonies of this species in the open steppe or in thickets of peashrub (*Caragana arborescens*) in the vicinity of Troitskosavsk [Kyakhta] and village Durena. Only once did they come across a pika in a ravine overgrown with shrubs.

According to M.N. Przheval'skii (E.A. Büchner, 1890) the Daurian pika occurs in the most fertile parts of the Gobi desert (northeastern Mongolia and Ordos).

M.N. Przheval'skii states: "North of the Ural, in the part of Mongolia where many forests and shrub grow, Ogotona is found in large numbers in thickets of shrub along rivers."

GENERAL DESCRIPTION AND HABITS. M.N. Przheval'skii (E.A. Büchner, 1890) gives the following description: "The behavior of the pika is strongly influenced by curiosity. If it has discovered a passing man or dog, it lets him approach to about 10 steps and then suddenly takes flight into its burrow. However its fear is overcome by curiosity. After a few 60 minutes, the head of the animal appears out of the burrow. If the object of alarm withdraws, the Ogotona immediately comes out and sits on its hind legs at the entrance of the burrow."

It is very easy to kill a pika. However, even when fatally wounded, it still has time to escape into its burrow. Therefore, only specimens killed on the spot become the hunter's booty.

G. Radde (1862) states that the voice of the Daurian pika is much more sonorous than that of the Alpine pika. According to A.N. Formozov, *O. daurica* emits a long, rolling trill gradually subsiding and becoming weaker at the end, sounding like: "pit'-pit'-pit'-pit'-pit', pi-pi-pi-pi". This resembles the warble of some birds, e.g., that of *Anthus trivialis*, and it can be heard at regular intervals.

A.N. Formozov writes that: "The pika is regularly active during the day, but it also often keeps awake during the night. We caught one at night in the hilly sands near Orog Nur while looking for hedgehogs with a searchlight. We often heard its whistle even in rainy and cloudy weather in complete darkness."

G.I. Radde (1862) also often heard the voice of these pikas at night.

BURROWS, NESTS, AND FOODSTORES. Based on observations in Mongolia and Gobi, N.M. Przheval'skii states "The burrows of this pika are usually built in colonies. Therefore, it one finds one burrow, one may find in the same area, tens, hundreds and sometimes even thousands of burrows."

A.N. Formozov (1929) found so many burrows in escarpments near Troitskosavsk [Kyakhta] that it was almost impossible to see the limits between different nests or colonies. The burrows of the Daurian pika on even ground had 2 to 5 exits with small mounds crossed by footpaths.

N.V. Nekipelov (1935) gives a different description of the burrows of the Daurian pikas: The burrows consist of many shallow corridors with numerous exits. The area of the burrow of one rodent is large, it may reach 25-35 sq.m. The number of exits is also very large, 15-20. The entrances are about 5 cm wide. The burrows of pikas apparently were inhabited previously by voles because a) old stores of voles could be found in excavated burrows; b) the galleries were narrow (3 cm wide). The pikas widened these galleries later and adapted them for their use.

G.I. Radde (1862) states that burrows of pikas are often built near the large burrows of tarbagans (Marmota bobak sibirica). In winter long winding burrows dug through the snow with air holes are often seen.

The Daurian pika prepares small "haystacks" for winter in front of the entrance of the burrow. The hay serves both as bedding and as food in winter. The efforts of the rodents are often wasted as this hay is eaten by cattle. In this case the rodent has to live throughout the winter on dry grass which it finds under the snow.

A.N. Formozov (1929) found stems of the following plants in the "hay stacks": Medicago ruthenica, Artemisia dracunculus, Potentilla tanacetifolia, Artemisia siversiana, Potentilla sibirica and Medicago falcata (the order of the plants in this list is according to their decreasing frequency).

61 A.N. Formozov says: "When the tips of the iris leaves have hardly begun yellowing in autumn, the pikas begin cutting them and piling them in large heaps near the burrows. The leaves are arranged in a star pattern and are moved from time to time. However, this does not prevent decay of some leaves deep in the heap. In addition to iris, the haystacks contained some grasses and artemisia. The stacks were about 50 cm wide and 35-40 cm high. Along the river Dzabhan Gol, pikas, the burrows of which were on low land under willow roots, arranged their haystacks near stones, trees and on stumps."

N.M. Przheval'skii found in the haystacks: grasses, artemisia, Compositae, Leguminosae, and twigs of peashrub. The food piles were carefully built like hayricks, always near the entrance of the burrow. G.I. Radde (1862) says that pikas cover their haystacks with branches of peashrub or Chenopodium to prevent scattering by the wind. Ogotona can live without water. N.M. Przheval'skii writes as follows: "In winter the animal obtains its water from occasional snow, and in summer from rain. If there is no rain, it uses dew, although this is rather rare here.

"It is a question what Ogotona drinks in spring and autumn when drought and extreme dryness of the air prevail often for months on the Mongolian upland."

The animals apparently use the moisture reserve of desert plants.

REPRODUCTION. A.N. Formozov writes as follows: "This rodent has several litters each summer. We continuously found young specimens during our expedition. A female caught on 2 Aug. (river Tuin Gol) had five young ready to be born. A female caught on 2 Sept. had 5 embryos 15 mm long, and it was still accompanied by 3 young of the previous litter which were about half as large as the mother."

J. Allen (1927) reports that he caught very young pikas, only 105 mm long, 20 miles south of Ulan-Bator (Urga) on 18-19 May 1922.

A.M. Kolosov caught a young pika only 75 mm long on 8 Jul. 1936 in the Chuya Alps along the river Chegan-Burgazy (2000 m).

There is a young specimen, 130 mm long, in my collection, which was caught on 25 Jul. 1934 in the floodland of river Toshtugovu, a tributary of the Shibita, 10 km from Toshakty. B.A. Kuznetsov caught a young specimen, 134 mm long, on 10 Aug. 1928 in the Aginskoe District near Lake B. Tsaga-Nor. These data confirm the assumptions of A.N. Formozov mentioned above.

The knowledge about molts in this species is fragmentary. A.M. Kolosov caught adults on the Chuya Alps on 5 Jul. 1936 and 9 Aug. 1936. The head and the greater part of the back of these two specimens was covered with summer fur. Winter fur was present only on the lower part of the back, and less on the flanks. A male caught on 10 Jul. 1936 in the same place was entirely covered with summer fur. The fur of a pika caught in Dalai Nor (17 May 1935) was intermediate though it had already much summer hair as a result of its early molt (on the head and part of the back). Pika No. 1762 in my collection caught near Troitskosavsk [Kyakhta] on 21 Oct. 1924 has a complete winter fur.

POPULATION DYNAMICS. The population of pikas, like that of many Lagomorpha, is subject to considerable yearly fluctuations. B.A. Kuznetsov (1929) writes that: "The population of Daurian pikas in the steppes of
62 southern Transbaikalia apparently undergoes considerable yearly changes. The Cossacks of the Chindant and Kulusutai villages were well acquainted with this animal by the name senokoska ("haystacker") or kuyun. They told me that the animal was very numerous in the adjacent steppes in 1927, but I only caught 3 specimens in 1928."

ENEMIES. The Daurian pika has many enemies. In winter it is hunted by snow owls, corsac foxes and wolves. According to N.M. Przheval'skii pikas suffer a lot from eagles and buzzards. This author writes: "The agility of these birds of prey is amazing. I witnessed buzzards repeatedly swooping so rapidly on an ogotona that the animal did not have time to dash into its burrow. We once saw the same done by an eagle who swooped on a pika sitting near the entrance of its burrow from a height of at least 30-40 sajenes*. Buzzards (Archibuteo hemilasius, i.e., Buteo ferox hemilasius Temm. et Schleg.) feed on pikas to such an extent that their hibernation sites in the Gobi are mainly chosen in connection with the population of pikas."

Subspecies of the Daurian pika

320. Ochotona (Ochotona) daurica daurica Pall. (1776).
Eastern Daurian pika

1776. Lepus dauuricus Pallas P., Reise durch verschiedene Provinzen des Russischen Reiches, III, S. 692.

1778. Lepus ogotona Pallas P.S., Novae species Quadrupedum e Glirium Ordine, pp. 59-70 (cliffs along rivers Selenga, Chikoyu and Dzhida).

1811. Lepus Ogotona Pallas P.S., Zoographia Rosso-Asiatica, p. 151.

1862. Lagomys ogotona Radde G., Reisen im Süden von Ost-Sibirien, S. 226-232 (Tarei-Nor).

1913. Ochotona daurica Kashchenko, N.F., Novye issledovaniya po mammologii Zabaikal'ya (New Studies of Mammals of Transbaikalia), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, XVII, p. 397 (Aga Steppe).

1927. Ochotona daurica Allen Gl., Lagomorphs collected by the Asiatic Expedition, Amer. Mus. Novit., No. 284, pp. 2-3 (20 miles southwest of Urga).

1927. Ochotona daurica Vinogradov, B.S. and S.I. Obolenskii, Materialy po faune gryzunov yuzhnoi chasti Eniseiskoi i Irkutskoi gubernii i Zabaikal'ya (Material on the Rodent Fauna of the Southern Part of the Yeniseisk and Irkutsk Provinces and Transbaikalia), Izvestiya Sibirskoi stantsii zashchity rastenii, No. 2, p. 15 (vicinity of Troitskosavsk [Kyakhta] and Durena).

TYPE LOCALITY AND DEPOSITION: In the famous work of Pallas "Reise" etc., BD. III, 1776, p. 692, we read: "Vivit in campis, montiumque declivibus arenosis apricis, per totam Dauriam...".

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* [Sajene: 2.134 m.]

In another work of Pallas, "Novae species Glirium", 1778, p. 60, the first locality mentioned in the description of the geographical distribution is mountains along river Selenga (Transbaikalia). This may be considered as "locus classicus".

It is unknown whether the holotype has been preserved.

MATERIAL EXAMINED: 22 pelts, most of them with skulls.

DIAGNOSIS. Color of summer fur on back rather pale, straw-gray with a slight ocher tinge which is especially marked on top of head. Ocher tones on flanks and cheeks distinct. Belly white, hairs with dark lead-gray bases and white tips; chest between forelegs with an indistinct pale straw spot; a shaded stripe extends from this spot to the middle of the belly. Winter fur on back and on top of head gray with a straw tinge; middle of back with blackish brown speckles caused by the black tips of the guard 63 hair. Straw tones more distinct on flanks.

Length of skull 38.5-44 mm (M. 42.4); condylobasal length 36.3-41 mm (M. 39.6); zygomatic width 20.4-21 mm (M. 20.8); width of skull at level of auditory meatus 19.2-20.2 mm (M. 30); length of upper tooth row 7.7-8.6 mm (M. 7.9).

Body length up to 180 mm (M. 175.5); hind feet to 28 mm (M. 27).

ADDITIONAL DESCRIPTION. The fur on top of the head straw-gray in summer with a more or less marked ocher tinge varying between pinkish buff and cinnamon-buff (Ridgway, 1912, pl. XXIX). Neck paler, with a more yellowish tinge (pinkish buff, Ridgway, pl. XXIX). Back pale, straw-gray with a slight rusty tinge, and with distinct dark brown speckling caused by the dark hair tips. Color of flanks more pure, ocher-straw (pinkish buff); same color present on cheeks. Spot on chest pinkish buff.

Winter fur much more grayish. Back generally straw-gray, with distinct blackish brown speckling caused by the dark tips of the long hair. Color of flanks similar to that of back but with less marked dark speckling and more distinct straw tones.

GEOGRAPHICAL DISTRIBUTION. Range including northern and central Mongolia, southeastern Mongolia and Ordos, southern Transbaikalia (Troitskosavsk [Kyakhta] and Verkhneudinsk [Ulan Ude] districts, valley of the river Onon, Aga and Daurian steppes, vicinity of Tarei Nor and Dalai Nor).

321. Ochotona (Ochotona) daurica altaina Thos. (1911). Western Daurian pika

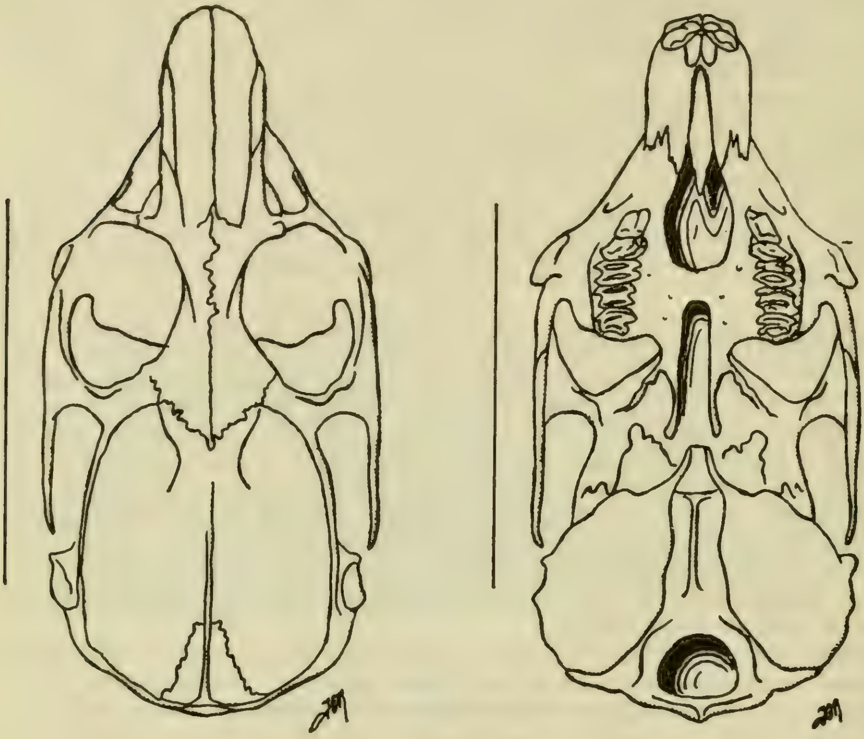
1911. Ochotona daurica altaina Thomas O., New Mammals from Central Asia mostly collected by D. Carruthers, Annals and Magaz. of Natur. History, Ser. 8, pp. 761-762; Thomas O., Annals and Magaz. of Natur. History, XIII, 1924, p. 164.

TYPE LOCALITY AND DEPOSITION: vicinity of Lake Achita Nur (northwestern Mongolia). Type No. 205 (collector's number) 27 Aug. 1910 (British Museum).

MATERIAL EXAMINED: 25 pelts with skulls.

DIAGNOSIS. Summer fur on back markedly grayer and duller than in typical form; ocher-straw tones weaker. Color of top of head like that of back. Rust-straw shades on flanks and cheeks very slight, covered by grayish tone. Straw spot on chest markedly paler and duller than in the typical form. Color of winter fur not much different from that of typical form, but perhaps paler.

Length of skull 44-47 mm (M. 45.9); condylobasal length 40.7-45.2 mm (M. 43.3); zygomatic width 21.7-23 mm (M. 22.2); width of skull at level of auditory meatus 21-21.5 mm (M. 21.2); length of upper tooth row 8.3-8.8 mm (M. 8.6). See Figures 21-25.



FIGURES 21, 22. Skull of Daurian (western) pika, Ochotona daurica altaina Thos. 9 July 1936. Collected by A. M. Kolosov from the Chuya Alps, Chegan-Burgazy

Drawing by Yu. A. Kostylev

65 Body length to 195 mm (M. 191.7); hind foot to 31 mm (M. 29.7).

This subspecies differs from the typical form in its grayer and duller coloration and its larger size.

GEOGRAPHICAL DISTRIBUTION. Chuya Alps along the Chegan-Burgazy (2000 m) by A. M. Kolosov (1936) near Tashakty (in the Gorno-Altai Autonomous Region), and near Lake Achita Nur (type locality), Suok (on the Altai) near Lake Üreg Nur (to the north of Lake Achita Nur), in Hobdo (specimens in the ZMAN collection).

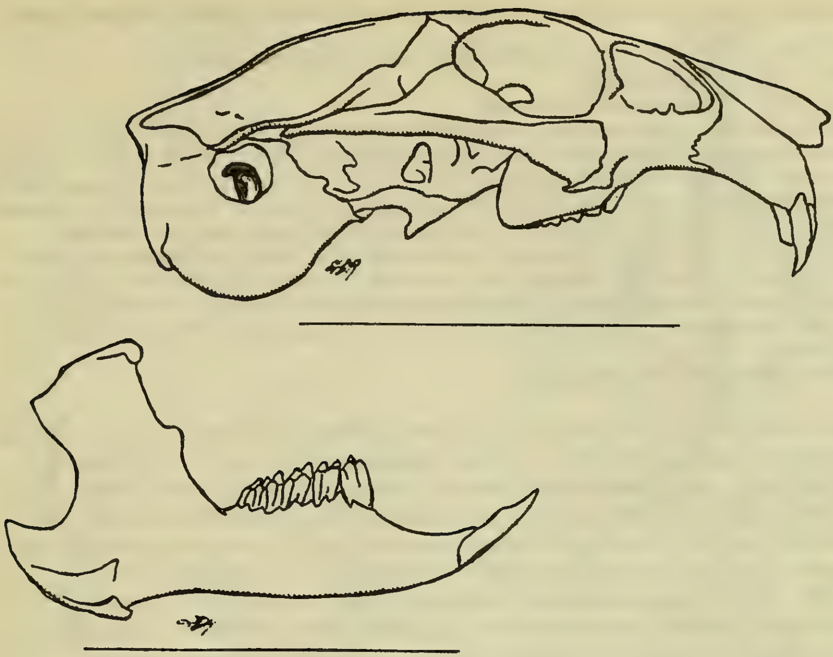
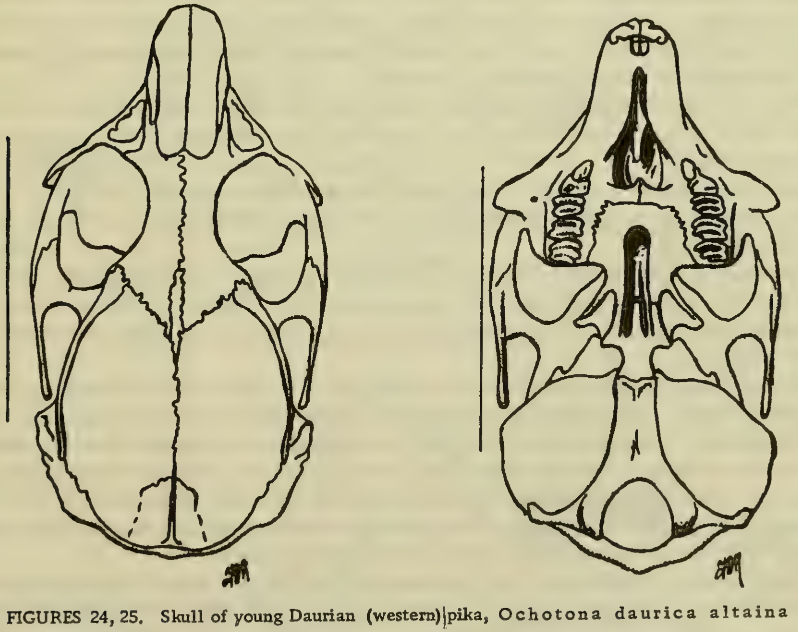


FIGURE 23. Skull of Daurian (western) pika, Ochotona daurica altaina Thos., (lateral) and mandible of same specimen as in Figures 21, 22



FIGURES 24, 25. Skull of young Daurian (western) pika, Ochotona daurica altaina Thos., Altai, Chuya Alps, A. M. Kolosov

Drawing by Yu. A. Kostylev

152. Ochotona (Ochotona) rufescens Gray (1842). Afghan pika

1842. Lagomys rufescens Gray J., Annals Magazine of Natural History, p. 266.

NAMES: The Afghan pika (English).

LOCAL NAMES: Gurukses-sichan (Turkmenian).

PRINCIPAL FIGURES: 1) Blanford W. F., Eastern Persia, II, Zoology, 1876, pp. 83-84, pl. VI, fig. 2 (entire animal in color); 2) Blanford W. F., The Fauna of British India, 1888, p. 458, fig. 148; p. 455 (skull); 3) Major Forsyth, On Fossil and Recent Lagomorpha, Transactions of the Linnean Society of London, Vol. VII, Zoology, 1896-1900, pl. 38, fig. 14, 29; pl, 39, fig. 34 (parts of the skeleton); 4) Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Material on the Rodent Fauna of Soviet Central Asia), II. Pishchukhi Srednei Azii i Kazakhstana (Pikas of Soviet Central Asia and Kazakhstan), Trudy Zoologicheskogo instituta Akademii Nauk, I, 1932, p. 46, fig. 5 (dorsal, ventral and lateral views of skull); 5) Flerov K. K. and I. M. Gromov, Mlekopitayushchie dolin Sumbara i Chandyra (Mammals of the Valleys of the Sumbar and the Chandyr), Trudy Karakalinskoi i Kzyl-Atrekskoi parazitologicheskikh ekspeditsii, 1934, p. 331. fig. 9 (structure of legs).

MATERIAL EXAMINED: 22 pelts with skulls.

66 DIAGNOSIS. Skull large in fully grown and old specimens. Skull length over 46 mm, reaching 53 mm. Interorbital space narrow, 3-3.8 mm in adults, convex. Well developed lateral crests present on both sides of interorbital space of adult and old specimens; the older the animal, the more do the lateral crests converge; the crests run along the lateral parts of frontals, forming the inner contours of the orbit. Nasals widened anteriorly, narrowing posteriorly after a slight constriction, their posterior part rounded with a narrow incision in the middle. Frontals without frontal fenestrae. Vomer visible, not covered ventrally by premaxillaries. Nasal and incisor foramina fused (Figures 26-29).

Most vibrissae dark brown; longest vibrissae almost completely white; vibrissae relatively short, 45-55 mm long. Soles whitish. Ears without distinct light margins.

Color of summer fur on back mainly pale gray (light-drab and even drab-gray, Ridgway, 1912, pl. XLVI), often mixed with a straw tinge (wood-brown, Ridgway, 1912, pl. XVI); tips of hair on back rust-brown; general color rust-brown (sayal-brown, Ridgway, 1912, pl. XXIX).

Color of top of head like that of back;, a pale stripe on the occiput. Flanks much grayer than back; belly dirty-whitish gray, often with a yellowish tinge.

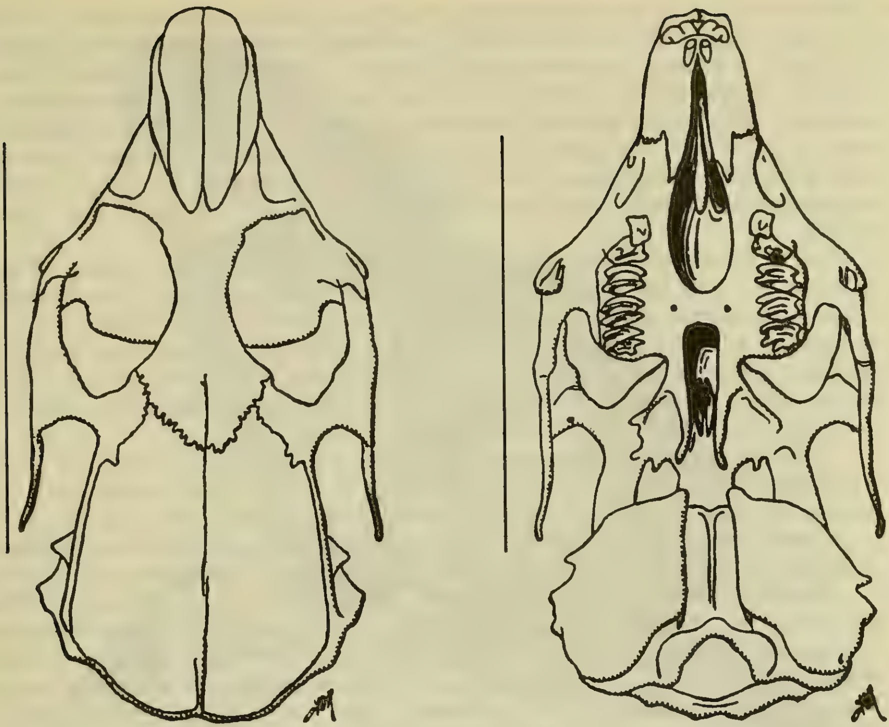
Winter fur duller, grayer and more brown than summer fur.

Body length up to 207 mm (M. 205); hind feet to 35.2 mm (M. 34.5); ear to 27 mm (M. 22).

ADDITIONAL DESCRIPTION. The bullae osseae of the Afghan pika are compressed laterally and narrowing anteriorly. Rostrum rather long; sagittal crest of adult, and especially of old pikas, well developed and clearly convex.

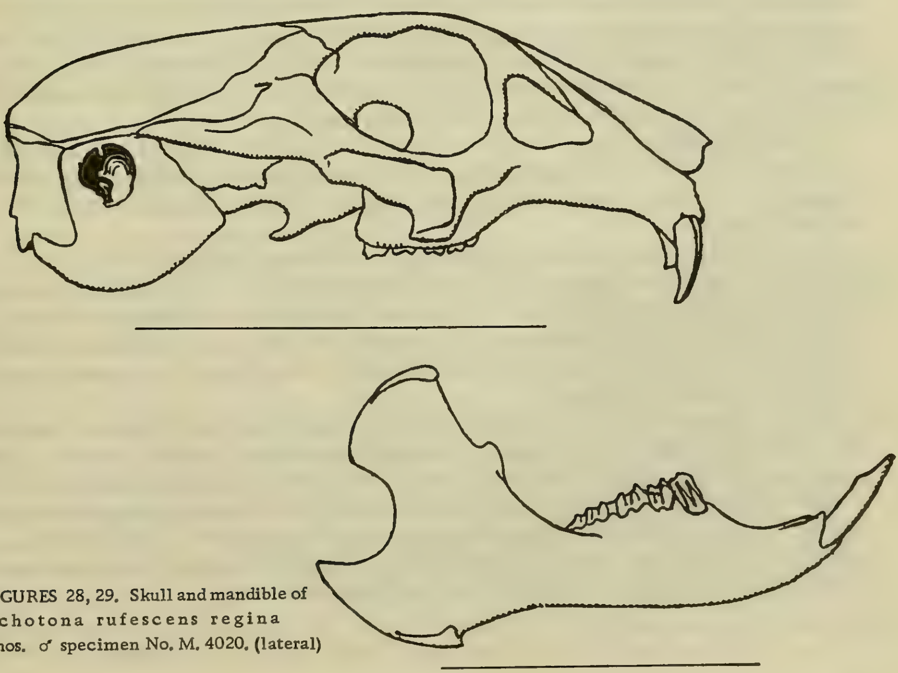
Skull of young pikas more convex in profile; interorbital area more strongly convex. The parieto-occipital region and the whole rostrum is more flattened, elongate and slanting in adults and old specimens; rostrum also more slanting. The width of the brain case in younger specimens measured behind the zygomatic arches either greater than that of old specimens or nearly as great. Ratio of this measurement to maximal length of skull 3.69 in old specimens and 2.99 in young ones.

Ground color of summer fur on back rather light gray (light-drab or drab-gray); this ground color is often mixed with a straw tinge (wood-brown); rust-brown shade distinct in middle of back (sayal-brown). Rusty tinge well marked on top of head (cinnamon-buff or cinnamon).



FIGURES 26, 27. Skull of Afghan pika, Ochotona rufescens regina Thos., dorsal and ventral, No. M.4020 ♂ 23 June 1925. Germab, Kopet-Dagh, S.I. Ognev's collection

Drawing by Yu. A. Kostylev



FIGURES 28, 29. Skull and mandible of Ochotona rufescens regina Thos. ♂ specimen No. M. 4020. (lateral)

68 Cheeks and stripe behind the ears around the neck light ash-gray. A rust-red stripe posterior to this stripe (between cinnamon-buff and cinnamon). This stripe widens markedly under the ear, and forms an elongated spot. In A.I. Argyropulo's opinion (1932) this spot is characteristic for this species. Ears covered with whitish gray hair; posterior parts and inner side of ears with rust tones. Flanks duller and grayer than back, sometimes with a slight yellow tinge. Belly dirty whitish, sometimes with a distinct straw-yellow shade. Feet whitish both dorsally and on the soles; claws black.

The richest colors are seen in old pikas, especially in males. The general color of the back is accompanied by a strongly varying reddish color of forehead and parietal area. The reddish tinge is relatively indistinct in some young females, but its rich tone can be seen from a distance in adult specimens. There is a yellow shade on the belly of old males which is usually absent in females of the same age. Females generally smaller and paler than males.

Color of young pikas nearly without any reddish tinge. Hair of back with well marked brown tips giving a bone-brown color to the whole back except the pale collar. Hair much softer than in adult specimens.

Winter fur duller and grayer than summer fur, intermediate between drab and hair-brown (Ridgway, 1922, pl. XLVI) with a slight reddish tinge

GEOGRAPHICAL DISTRIBUTION. I wrote with V. G. Heptner: "This pika is widely distributed along the Kopet-Dagh and the Bolshie Balkhany ("Mammals of Central Kopet-Dagh" "(Mlekopitayushchie Srednego Kopet-Daga), 1925, p. 77) According to our observations the distribution of this species is very irregular and sporadic We noticed on our expedition that pikas were rare in the mountains near the village Verkhneskobelevskii. We did not find any on the road along the border from Verkhneskobelevskii to Mikhailovskii (Germab) Near Mikhailovskii (Germab) it is already common, occasionally occurring in large numbers. We found the following colonies in this region: 1) in the estuary of river Sakis-Yab (Germab); 2) a large colony in a ravine to the west of the village, near the so-called "Cossack camps". We also found it along the precipitous walls of the broad valley from the Germab frontier post to the Kheirabad frontier post (which is now ruined).

"Near the village Dmitrievskii (Kurkulab) Ochotona is numerous along a ravine of the river Mergen-Uli, about 8 versts above the village and most common near the village itself. We did not find this species near the village Sulyukli."

A.I. Argyropulo (1932) recorded the following localities for O. rufescens from material in the ZMAN collection: vicinity of Kizil-Arvat; the Bol'shie Balkhany Range and Kazandzhik Mountains (near the junction of the Malye Balkhany Mountains with the Kyuren-Dagh Range). P. Varentsov (1894) states that it occurs on the Kopet-Dagh near Gaudan and in the Firyuza Ravine.

69 K.K. Flerov and I. M. Gromov (1934) recorded the following localities for this species. The largest colony was found on the Chandyr mountain pass in a narrow ravine at the bottom of which runs the Karakala-Chakankala Road. A second, smaller colony, was found 15 km from Kara-Kala, where the Sumbar river flows between rocky ranges on both sides The third, smallest colony was found on the slopes of the Skalistoe Ravine between the Naarli outpost and Kizil-Imam (in the Chokhrok plot).

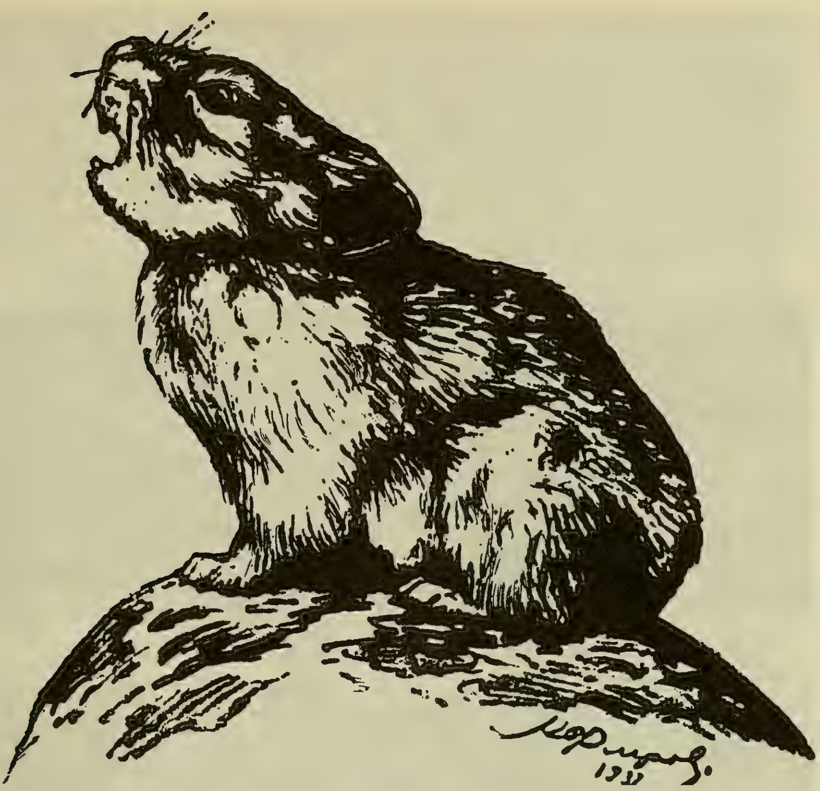


FIGURE 30. Ochotona rufescens regina Thos., calling

Drawing by K. K. Flerov

This species was found by A. M. Nikol'skii in northeastern Iran (near Aber, Nardin and Bojnurd). O. rufescens is undoubtedly widely distributed throughout Iran. It was recorded by W. T. Blanford (1876) from Korud north of Isfahan. According to Blanford (1888) it is found in Afghanistan near Quetta, and in northeast India; according to Thomas (1920) it is found near Kalat in Central Baluchistan.

O. rufescens is widely distributed, but occurs in Russia only at the extreme northeastern tip of its range.

MODE OF LIFE. HABITATS. The irregular distribution of the species
is connected with the specific habitats of these animals. They inhabit almost
exclusively slopes of ravines, and avoid flat country and valleys. The
70 favorite habitats of these animals are gradual slopes, but they sometimes
occur on steep escarpments. They occasionally occur near cultivated land
if they find stones and rocks. I found numerous pikas near the village
Kurkulab in adobe fences of settlements and along roads. These adobe walls
("duvals") were completely perforated by burrows, like sponges.

P. Varentsov ("Fauna of the Transcaspian Region" (Fauna Zakaspiiskoi oblasti) Ashkhabad, 1894, p. 14) found a colony of pikas in a plain. He writes as follows: "I found a large colony of pikas in the Firyuza Ravine in the Kopet-Dagh 5 versts from the road from the Ak-Tepe military camp to the village Kozelnoe. The burrows of the pikas were under stones, not on mountains as in Guadan, but in the foothills. Burrows were occasionally dug in soft ground of a large valley covered with lush vegetation. The

Firyuzinskii Brook (Izgand-Su) runs along this valley. The valley is about 6000 ft above sea level, and it is surrounded by high stony mountains without any vegetation."

GENERAL DESCRIPTION. HABITS. I wrote with V. G. Heptner (1925): "This animal is usually very trusting and graceful. Its appearance, behavior, and facial expression remind one of a small rabbit, quite different from the drawings of this species given by Mützel et al. Its movements are rather phlegmatic. Quietly coming out of its burrow, it sits for a long time in front of its entrance with its four legs folded.

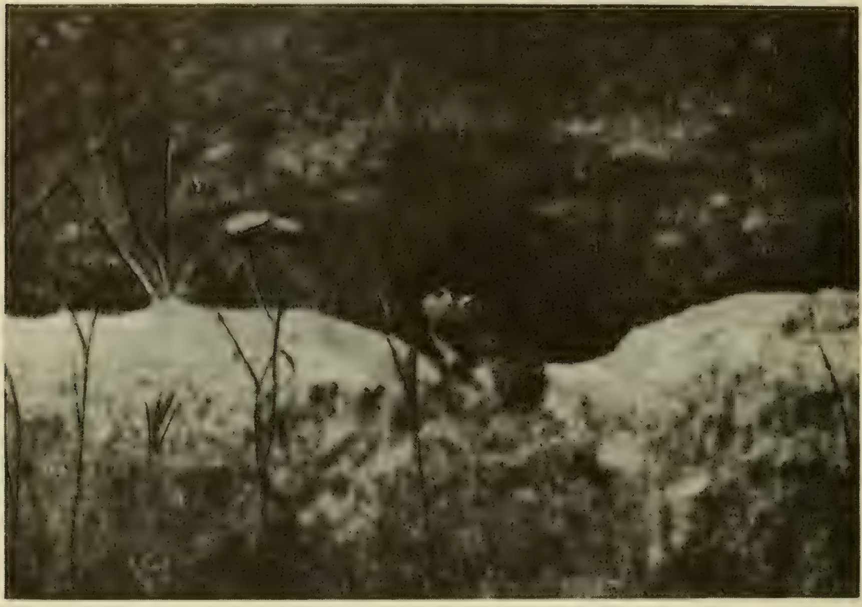


FIGURE 31. Afghan pika Ochotona rufescens regina Thos., on an adobe fence in the Kopet-Dagh

Photograph by S. I. Ognev

71 "It moves quickly when disturbed and settles again observing. Sometimes it behaves quite differently, demonstrating how rapidly it can move. It runs in curves. Its movements are between the running of a mouse-like rodent and the leaps of a very short-legged rabbit. Both feet of the animal touch the ground when it runs, as in hares. After having run some distance, it invariably stops near its burrow, folds all four legs and observes calmly. This is a very characteristic posture in which it is very similar to a hare. A hasty movement of the observer suffices to make it jump to its burrow in one bound, so rapidly that it cannot be followed by the human eye. However, the animal is curious and will come out of its burrow again after a short time."

Strangely enough, we heard its voice only once. It was a very weak, melodious squeak. P. Varentsov (1894) describes the voice of this species as monotonous. If alarmed it gives a peculiar prolonged cry.

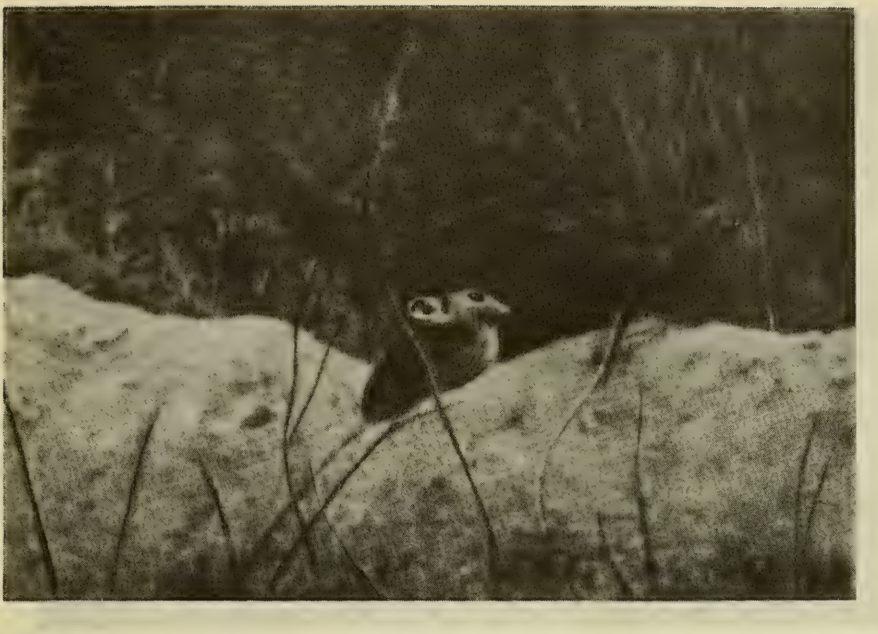


FIGURE 32. Afghan pika Ochotona rufescens regina Thos., in the Kopet-Dagh Mountains
Photograph by S. I. Ognev

K.K. Flerov and I.M. Gromov (1934) write as follows on the voice of Ochotona rufescens: "The voice ... is very weak, and can be heard only for a very small distance. It has nothing in common with the true bird songs of the Daurian pika or with the loud cry of O. hyperborea. It is a short, almost soundless warble starting with a very short, hardly audible whistle followed by a series of dry, jerky sounds resembling the
72 suppressed rattling of an alarm clock. Its voice sounds about like "fyu-trrrrrrrr". One specimen ended the warble very rapidly, drumming the ground with its hind feet."

DAILY LIFE. According to our observations in the Kopet-Dagh (June 1925) the pikas are diurnal. There was a prolonged drought and hot weather in 1925. Pikas appeared early in the morning, soon after sunrise. They fed and were active to 8-8:30 a.m. when the heat became intense. They could also be seen after 5-6 p.m. when the heat subsided. However, they were more sluggish than in the morning. In spring and fall, when the weather is cooler, the animals are generally much more active than in summer.

BURROWS AND NESTS. I wrote with V.G. Heptner (1925): "On stony slopes, the entrance of the burrow is always under a large stone, or it leads into a deep crevice. Burrows are generally built near a group of several stones and the animal often sits on the stone overhanging the nest. There is always a small, flat, beaten and completely clean landing in front of the burrow (about 1 sq. ft.) which is usually roofed by an overhanging stone. This is the balcony of the animal where it sometimes sits for long periods in the shade of the overhanging block. It apparently does not
73 move far away from its burrow. We never saw a pika more than 50-100 steps from its burrow. There is always a small heap of excrement near

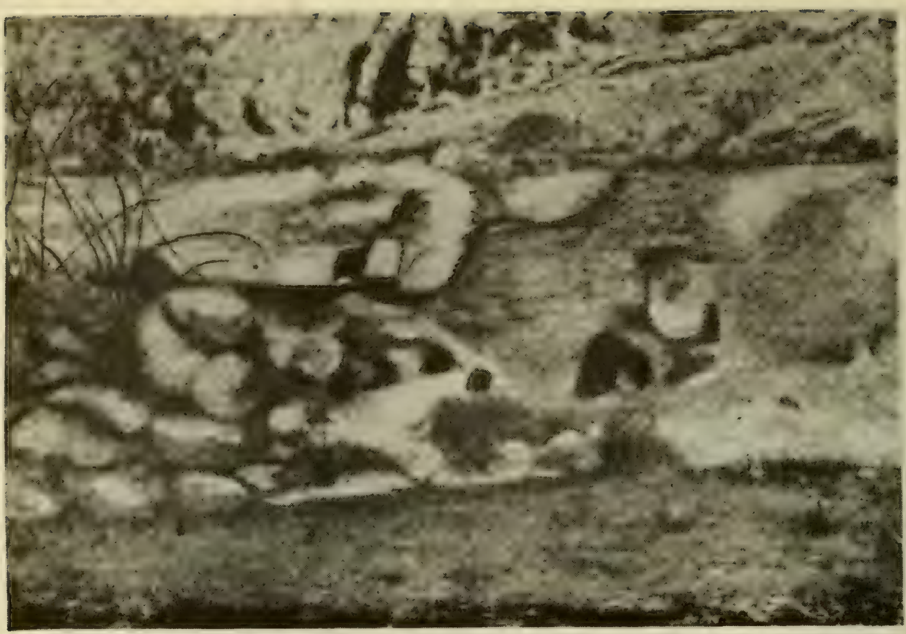


FIGURE 33. Burrows of Afghan pika in an adobe fence in the Kopet-Dagh Mountains

Photograph by S. I. Ognev

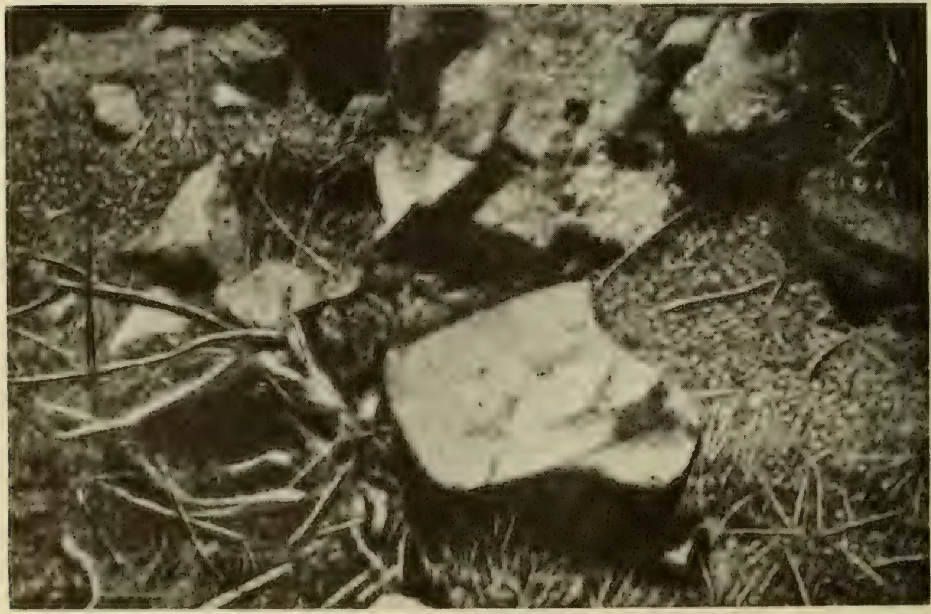


FIGURE 34. Near the entrance of the burrow of the Afghan pika. The burrow is in a ravine among stones. Excrements are visible near the entrance. Germab Ravine, Kopet-Dagh

Photograph by S. I. Ognev

the burrow. Pellets accumulate in rather large quantities, sometimes large handfuls. They look like pellets of hares, but are much smaller (3-4 mm). Only rarely did we find fresh feces near inhabited burrows. The excrements were usually completely dry. However, they dry very rapidly here."

"...The pika burrows with preference in adobe walls near roads. The burrows in this habitat are of a peculiar type which is worth describing. The fence is about 1 meter high. The exits of the burrow open at the base of the fence at both sides. Their diameter, as that of the galleries, is about 7 cm. The exits are sometimes widened because the soil crumbles. There is rarely only a single exit. There are usually 3-4, which apparently belong to the same network. Burrows built among the rocks have several exits, but single burrows also often occur there. This is rare in fences. The softness of the ground apparently enables the animal to build numerous galleries with exits. There are often simple transverse tunnels under the 74 wall. The main gallery usually leads from the base of the fence into the ground. In broken walls galleries often run along the wall for a long distance. Exits are sometimes 1/2 meter above the ground. The animal apparently loses its direction and makes an accidental opening. This crumbles and eventually becomes very large, but it is apparently not used as an entrance.

"The pika is very agile and jumps very well. It can jump onto a wall about 1 meter high without any apparent effort.

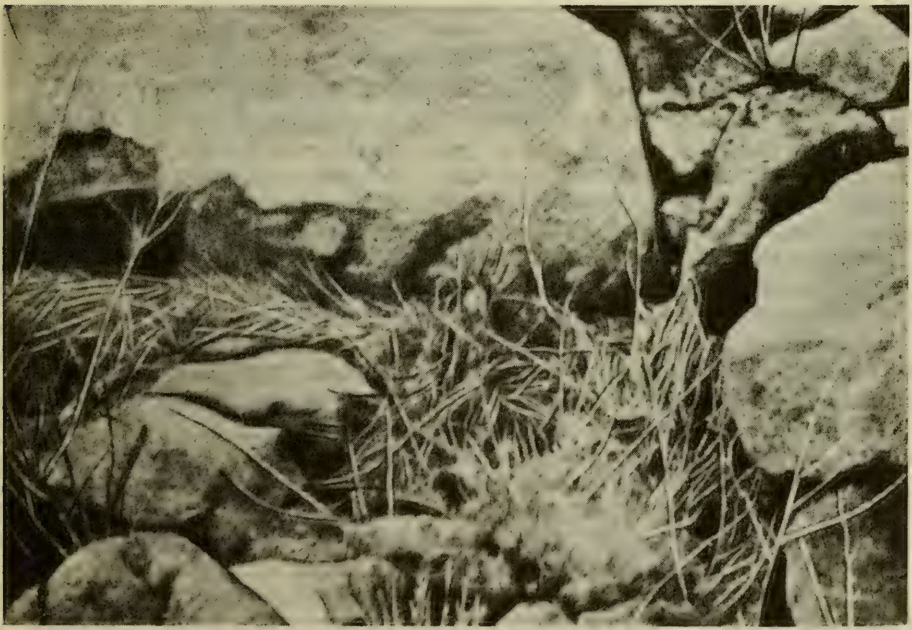


FIGURE 35. Dry hay reserves near the entrance of the burrows of the Afghan pika, Germab Ravine in Kopet-Dagh
Photograph by S. I. Ognev

We found a burrow near the Dmitrievskii village in a crack in a monolithic rock. The animal had, each time, to jump onto a small platform (about one-tenth sq. m) before the entrance into the crack 1/2 m above the ground.

"A considerable quantity of soil accumulates near burrows in walls along roads. Small balconies are formed by this soil in front of the entrances, especially in places where a gutter runs at the base of the wall. Along the base of these walls there are cornices (about 7 cm wide) formed by the rejected soil. These cornices transform the sloping wall of the gutter into a horizontal surface along which the animals run along the wall. Such tracks occasionally run for a long distance, covered here and there by weeds or shrubs.

75 "An unusual type of burrow was found once near the Dmitrievskii village (Kurkulaba). Several exits were located under a Capparis shrub on a small mound of earth. The form of the exits seemed to be that of a desert hare but small pellets were found near the burrow."

FOOD AND FOOD STORES. O. rufescens is modest in its food requirements. In food stores near burrows we found dry Artemisia and Ephedra. It cuts the long thorny stalks of ephedra and dries them by pushing bunches into cracks between stones near the burrows. The store is sometimes under the stones overhanging the entrance. A large part of the stores is apparently taken deeper into the burrows. Food stores are undoubtedly collected twice a year: a) in spring, when the rich vegetation comes to an end because of the onset of heat; b) in autumn, when the vegetation is revived by rain. The autumn reserves are prepared for the winter. Pikas living in "duvals" and near plantations eat alfalfa avidly. We also found apricots whose flesh had been eaten but the kernels had been left intact.

We have no data about the reproduction of the Afghan pika. We did not find any young specimen of the same year during our expedition to Kopet-Dagh (1925). According to local hunters, the females suckle their young in June in the burrows and never, or only very rarely, come outside. They feed then on stores collected in the spring. The males live in separate burrows at this time and have no responsibility towards their family. They frequently come outside. This is probably the reason why there are so many more males than females in our collection.

MOLT. In spite of the hot climate of Turkmenia, the spring molt takes place rather late. We caught a female near Germab in June 1925 (M. 4011) with winter fur persisting on the lower part of the back and on the flanks. Most of the back of a male (M. 4017) caught on 21 Jun. 1925 (Kurkulab Ravine) was covered with strongly worn winter fur. The molt proceeds from the head to the hindquarters, as it is typical in the spring molt of Ochotona. Finally, the winter fur in a male (M. 4016) caught on 30 June 1925 (Germab Ravine) persisted in a few traces on the lower part of back and on the flanks. Based on the examination of material from the Sumbar and Chandyr Valleys, K. K. Flerov and I. M. Gromov (1934) came to the following conclusions about molt of the Afghan pika. The summer fur grows during June and in early July. In the second half of July and first half of August, the animals bear the summer fur. The winter fur begins growing from the second half of August, and even earlier. This ends in the second half of September. The young are born in winter fur. The summer fur begins growing in the second half of July. Immediately after the summer fur has grown, the molt into winter fur starts again. The higher the pikas live, the longer they

76 probably wear their winter fur, and the later begins the spring molt.

LIFE IN WINTER. The Afghan pika does not hibernate like its relatives. With the onset of winter, the animals block their burrows. They come out only to take hay from their "haystacks" or to catch a breath of fresh air on a nice sunny day. On the 20th of December 1892, P. Varentsov saw many pikas on the Gaudan jumping over the rocks. Eleven were shot and were found to wear a complete winter fur.

LIFE IN CAPTIVITY. According to P. Varentsov (1894), pikas are very delicate and have to be treated carefully in captivity. It is difficult to keep them in a room because they are very unclean. Their copious urine has a strong, very disagreeable smell.

322. Ochotona (Ochotona) rufescens regina Thos. (1911). Kopet-Dagh pika

1885. Lagomys rufescens Nikol'skii, A. M., Materialy k poznaniyu fauny pozvonochnykh severo-vostochnoi Persii i Zakaspiiskoi oblasti (Material on the Vertebrate Fauna of Northeastern Iran and the Transcaspian Region), Trudy Sankt-Peterburgskogo obshchestva estestvoispytatelei, p. 7.

1890. Lagomys rufescens Radde G., Walter A., Blasius W., Die Saugethiere Transcasp., Nauchnye rezul'taty, Tiflis, p. 7.

1894. Lagomys rufescens. Varentsov, P., Fauna Zakaspiiskoi oblasti (The Fauna of the Transcaspian Region), pp. 11-14.

1911. Ochotona rufescens regina Thomas O., On New Mammals from Central and Western Asia. Annals and Magaz. of Natur. History, p. 762.

1929. Ochotona rufescens regina Ognev S. I. and Geptner, V. G., Mlekopitayushchie srednego Kopet-Daga; prilezhashchei ravniny (Mammals of the Central Kopet-Dagh and the Adjoining Plain), Trudy Nauchno-issledovatel'skogo instituta zoologii, 3(1):75-81.

1932. Ochotona rufescens Argyropulo A. I., Materialy po faune gryzunov Srednei Azii, Pishchukhi Srednei Azii i Kazakhstana (Material on the Rodent Fauna of Soviet Central Asia. Pikas of Soviet Central Asia and Kazakhstan), Trudy Zoologicheskogo instituta Akademii Nauk, 1:45-48.

TYPE LOCALITY AND DEPOSITION: In the Kopet-Dagh Mountains, to the west of Ashkhabad. Type in the British Museum.

MATERIAL EXAMINED: 22 pelts with skulls.

DIAGNOSIS. Resembling the species in general (vide supra), O. rufescens Gray differs from the nominal Afghan race by its larger size*. Length of skull 44-53.2 mm (M. 50.3); condylobasal length 44.5-48.7 mm (M. 46.4); zygomatic width 23-25 mm (M. 23.8); interorbital space 3-3.8 mm (M. 3.4); length of upper row of molars 9.4-10.2 mm (M. 9.5); Length of body and head 150-219 mm (M. 205); hind feet 31-36 mm (M. 34.5); ear 19-25.2 mm (M. 22).

SYSTEMATIC NOTES. I consider the Turkmenian race of reddish pikas as belonging to Ochotona rufescens regina. This subspecies was described by O. Thomas from collections by Littledale from a locality west of Ashkhabad (Kopet-Dagh Mountains). The typical O. rufescens rufescens Gray was described from the east Afghanistan Mountains (Kabul Region). According to Thomas, O. rufescens regina differs from the typical form in its larger size and large skull with typical bullae osseae. O. Thomas states that the bullae of the Turkmenian pika are larger than those of the typical race, and those of the central Iran O. rufescens vizier Thos. The holotype of O. rufescens vizier Thos. is the specimen described and drawn by Blanford. ("Eastern Persia

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* According to data of O. Thomas. I have not seen typical rufescens specimens and cannot give an opinion.

77 II, 1876, pl. VI, Figure 2). This specimen was caught in Korud, north of Isfahan*. According to Thomas, O. r. vizier differs from the typical form in its small size and richer and more saturated color. Its ears are shorter and its bullae osseae are smaller than those of the typical race. O. Thomas described O. r. vulturna Thos., from the vicinity of Kalat (Baluchistan) which is smaller than the typical form but larger than vizier. The color of its winter fur is more monotonous yellowish red than that of the closely related subspecies.

I can discuss these systematic questions, unfortunately, only from the literature. I have only material of the Turkmenian pika and no pelts from Iran, Afghanistan, and Baluchistan.

A.I. Argyropulo (1932) considers the Tibetan O. curzoniae Hodgson as definitely identical with rufescens.

This seems doubtful. W.T. Blanford (Fauna of British India, 1888, p. 457) definitely states that O. curzoniae Hodgson and O. roylei Ogilby are closely related. According to O. Thomas (On Some New Forms of Ochotona, Annals and Magaz. of Natur. History, ser. 9, Vol. IX, pp. 189-190, 1922), curzoniae differs sharply from rufescens in a number of characters. These questions can be solved only by examination of more material.

I have discussed the geographical distribution of O. r. regina Thos. in detail above.

153. Ochotona (Ochotona) pricei Thomas (1911). Price's pika

1911. Ochotona (Ogotoma) pricei Thomas O., Mammals from Central and Western Asia, Annals and Magazine of Natural History, ser. 8, No. 48, Vol. VIII, p. 760.

PRINCIPAL FIGURES: 1) Formozov A. N., V Mongolii (In Mongolia), Moskva, 1928, pp. 75 and 98 (drawings of entire animal); 2) Formozov A. N., Mlekopitayushchie severnoi Mongolii po sboram ekspeditsii 1925 goda (The Mammals of North Mongolia in Collections of the 1925 Expedition), 1929, p. 91, fig. 15 (skull dorsal and ventral); p. 93, fig. 16; p. 94, figs. 17-18 (characteristic postures of pikas, sketches from nature); 3) Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Material on the Rodent Fauna of Soviet Central Asia), II. Pishchukhi Srednei Azii (2. pikas of Soviet Central Asia), Trudy Zoologicheskogo instituta Akademii Nauk, Vol. I:49, 1932. fig. 6 (skull dorsal, ventral and lateral).

MATERIAL EXAMINED: 36 pelts (most of them with skulls).

DIAGNOSIS. Skull in general similar to that of O. daurica, of average size. Length 44-49 mm. Interorbital space relatively narrow (3.5-4.7 mm) and arched in the middle. There are median crests branching anteriorly and posteriorly in old specimens which may pass to the parietals. Nasals gradually widening anteriorly. Lateral contours of nasals gradually
78 narrowing posteriorly, their posterior part rounded. Frontals without fenestrae. Vomer covered ventrally by the margins of the premaxillaries. Palatine and incisor foramina separate (Figures 36-38). Vibrissae dark brown; longest vibrissae with long, white tips, 60 mm long. Soles whitish, sometimes with straw-grayish tinge. Light margins of ears very indistinct.

Color of summer fur on back varying in different subspecies between ocher-rust-gray (cinnamon-buff, Ridgway, 1912, pl. XXIX) with some grayer and rust tones (cinnamon and clay color, pl. XXIX) and duller, grayish brown tones with a slight yellow tinge; the combination of these colors creates a general impression of drab.

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* K.K. Flerov and I.M. Gromov (1934) consider the Asterabad pikas as belonging to this form.

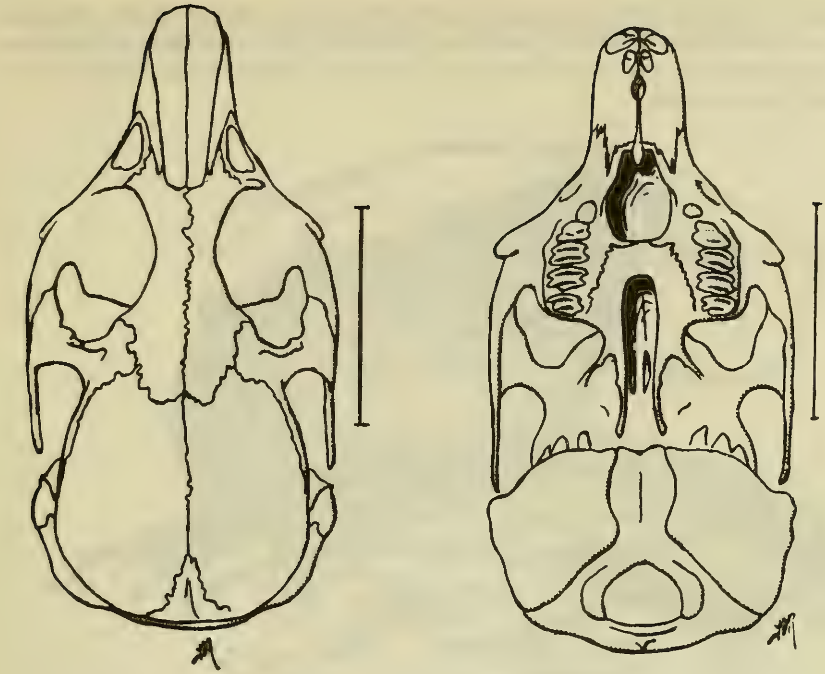

FIGURE 36. Skull of Price's pika, Ochotona pricei Thos., No. M.3974 10 September 1926. Central Mongolia, Tsagan-Adzir Mountain, 100 km south of Uliassutai [Jibhalanta], A.N. Formozov, S.I. Ognev's collection

Drawing by Yu. A. Kostylev

Winter fur on back beautiful straw-gray with a pinkish rust tinge (avellaneous).

Body length to 200 mm (usually about 180 mm); hind feet to 33 mm (usually about 30 mm).

GEOGRAPHICAL DISTRIBUTION. This species was described by O. 79 Thomas (1911) from 3 subadult specimens collected by D. Carruthers' expedition near Lake Achita-Nur and near Suok, in the upper reaches of the river Hobdo Gol basin (northwestern Mongolia), at altitudes of 6700 and 8000 ft.

According to data from A.N. Formozov's expedition (1929) it was found in north and central Mongolia between Urga and Lamangegen. Numerous remains of this species were found in the disgorged pellets of the eagle owl on slopes near the river Shargain Gol, southwest of the intersection of 46° N and 102° E. Farther to the west, this species was found near the Lamangegen Monastery. Near Uliassutai [Jibhalanta] it reaches the Tsagan-Adzirga Mountain in the north. In the south it occurs on the Gobi Altai, where specimens were caught in Yihe-Bogdo.

Glover Allen (1927) recorded the species from the following localities: Gun Burpe; Ussuk; Artsa-Bogdo; and 40 km from Tsetsen Han [Öndör Han].* A.I. Argyropulo mentions that Price's pika is found near the village Choirin on the Kalgan (Changkiakow) highway. A.M. Belyaev (1933) states in an article on the rodents of Kazakhstan that this species occurs in the southern part of the Kazakhstan Plateau, near the valley of the river Syry-Su and the Ulu-Tau Mountains to the river Tokrau. Its range reaches approximately 48° latitude in the north.

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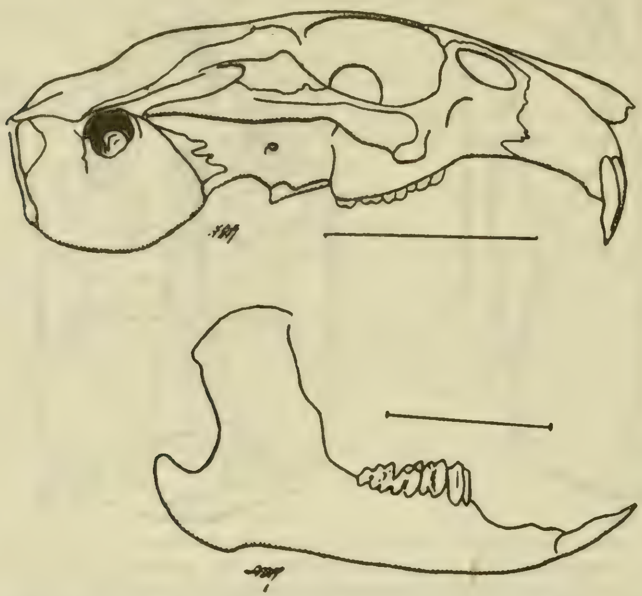
* In Allen's work, Tze-Tzen Wang.



FIGURES 37, 38. Skull and mandible of Ochotona pricei Thos. (lateral) No. M.3974

There are two specimens of this species in the ZMAN collection caught in the former Kedei subdistrict of the Karkaralinsk county of the Semipalatinsk Region. V. A. Selevin (in litt., 1935) kindly put the following data on the distribution of this species at my disposal. Price's pika is replaced in the desert by O. pusilla south of Karaganda, northwest of Balkhash in the direction of Berty-Su. V. A. Selevin recorded O. pricei near the Karaurun Hills. It is also numerous in the valley of the river Emek. A colony was found in eastern Bet-Pak-Dala near Kara-Ungur along the Chakchagailydzhel (in the northeastern part of the desert), and a skull was found in disgorged pellets of the eagle owl. It was also found on the Altai in the Chuya Steppe (ZMAN collection, Romanov, 1841) and near the Talduchinskii Glacier in southeastern Altai, west of the Chuya Steppe). O. Thomas (A New Pika from the Altai, Ann. and Magaz. of Natur. History, XIII, 1924, pp. 163-164), in his description of Ochotona sushkini (=pricei) claims that it occurs in the northeastern Altai. This is incorrect because the specimen of P. P. Sushkin was from the southeastern Altai.

80 MODE OF LIFE. The only data on the biology of this pika are given in A.N. Formozov's work (1929):

"The distribution of O. pricei is sporadic. It occurs in isolated colonies, and in localities which are often far from each other although suitable conditions exist in the area between them. This isolation may be the reason that traces of extinct colonies are sometimes found in the desert.

These colonies can come back to life only rarely, because the next colonies are too far away. Such traces of extinct colonies are mounds of fine gravel

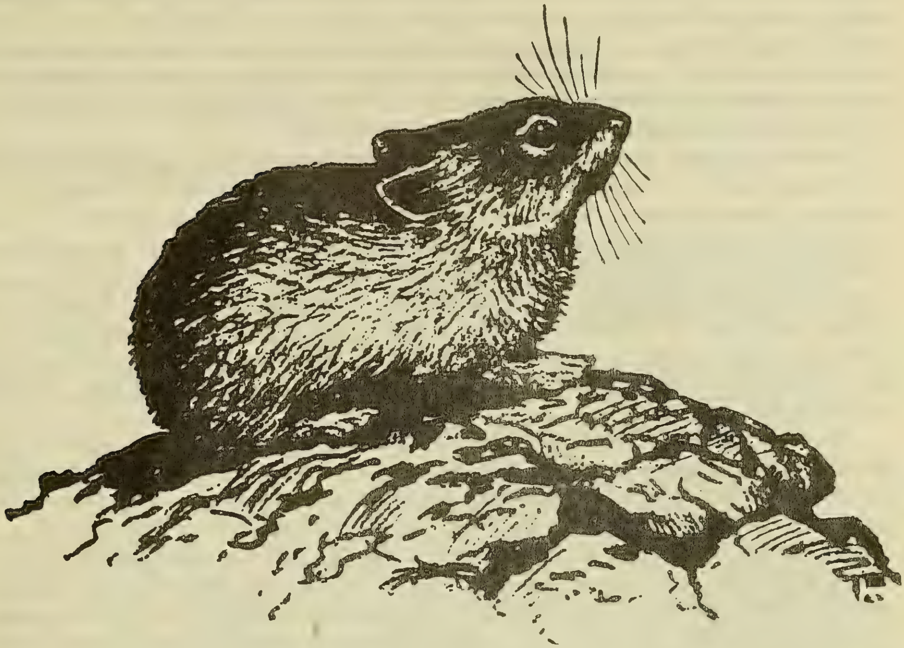


FIGURE 39. Price's pika, Ochotona pricei Thos.

Drawing by A. N. Formozov

excavated by pikas at the base of rocks covering the burrows. We will discuss these structures below.

"As to the favorite habitats of O. pricei, we can say the following: it was most numerous in rocks with deep passages, and in the residual outcrop scattered over the desert. These passages produced by water, sun and wind, and cracks between structures are most preferred by them. They can often be observed lying on flat rocks, basking in the sun. They sometimes rest in their niches seeking protection from the wind. They dig burrows under such rocks or near them. However, we rarely also found burrows in rockless deserts, under peashrub. To our surprise, we found some colonies in the valley of the river Dzabhan which had built their burrows (each with 5-8 exits) under sandhills overgrown with Stipa splendens or on areas covered with stones with isolated peashrubs. We also found Daurian pikas near this place. On the Yihe-Bogdo, O.
81 pricei is found mainly on higher ground in pastures where Capra sibirica graze, and near marmot colonies. The pikas take refuge in their burrows in case of need.

"The range of this rodent thus reaches from the valleys to altitudes of about 8000 ft.

"Burrows of Price's pika are usually under rocks or bushes. The width and shape of the entrances vary considerably. The entrance may be either horizontally or vertically elongate, its width 50-120 mm. There are nearly always deep paths through the mound of earth excavated from the burrow. O. pricei collects large heaps of rubble (to 1 m long) consisting of small stones (5×5 cm), dry camel and horse dung, and pieces of peashrub twigs, near the large flat stones under which the burrows are, and at the base of small rocks. These heaps sometimes surround the base of the rock and occasionally form small hillocks. The entrances of the burrows were blocked with such rubble in some cases. The pikas possibly collect this material to block cracks against water and wind.

"Heaps of grass spread to dry may be found on densely populated rocks during the day. Large stores of hay fill large hollows in the rocks, or cavities under stones. The hay consisted of the following plants: 1) store in a niche among rocks on 30 Jul. 1926 in the lower reaches of river Tuin-Gol (♀ 84) — Artemisia pectinata, Euratia coratoides, Carex stenophylla, Tanacetum achillaeoides; 2) store under stones on 1 Sept. 1946 between rivers Baydarag Gol and Dzabhan Gol Tanacetum achillaeoides, Carex stenophylla, Artemisia sp.; in a third case, grasses and Aster altaicus were found in addition to the above plants.

"When foraging, the pika is very cautious, hurrying to the rocks at the first alarm. However, after it reaches its refuge, it does not hide long in its burrow, but appears again outside after a short time. The traces in the sand indicate that O. pricei does not go farther than a few tens of meters from its burrows. It is fond of rocks, and moves rapidly over steep surfaces, and has a peculiar way of folding its rather large and broad ears. These habits make it easy to distinguish it from the Daurian pika. We never heard O. pricei give the prolonged whistle characteristic of O. daurica. When it is frightened, it gives a short and sonorous whistle. O. pricei apparently has several litters during summer. No. 93* ♀ (1 Aug.) was suckling young (milk in the mammary glands); 191* ♀ (1 Sept.) had a completely developed embryo. We could observe well developed young at the same time, which were certainly born in the same summer."

G. Allen (1927) reports that some small young pikas were caught on 31 May and 1 Jun. 40 miles south of Tsetsen Han [Öndör Han]. Other specimens of the same size were caught on 21 Jun. near Gun Burte; 25 Jun. near Ussuk and 11-24 July near the Artsa-Bogdo Range.

82 *Subspecies of Ochotona pricei Thos.*

This species has a well defined subspecies in the Karkaralinsk Region, which was described under a separate name by A.I. Argyropulo in his monograph in the "Fauna of the U.S.S.R." (Fauna SSSR) (in litt.) O. sushkini Thos. (vide infra) is certainly identical with O. pricei. O. hamica Thos. ** which was described from Hami [Quomul] south of the eastern spurs of the Tien Shan) is also closely related to O. pricei.

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* Numbers of the collection of A. N. Formosov.

** O. Thomas, Annals and Magazine of Natural History, ser. 8, 1912, p. 407.

323. Ochotona (Ochotona) pricei pricei Thomas (1911). Mongolian pika or Price's pika

1867. Ogotoma Pallasii Gray I. E., Notes on the Skull of Hares (Leporidae) and Pikas (Lagomyidae) in the British Museum, Ann. and Mag. of Natural History, Vol. XX, p. 220.

TYPE LOCALITY AND DEPOSITION: Mountains to the west of Lake Achita-Nur (near 90° E and 49°30' N), at an altitude of 6700 ft, in the Hobdo Gol Basin, northwestern Mongolia. Type in the British Museum, London.

MATERIAL EXAMINED: 34 pelts with skulls.

DIAGNOSIS. Color of summer fur on back ocher-rust-gray (generally, cinnamon-buff, Ridgway, 1912, pl. XXIX) with some grayer and rustier tones (cinnamon and clay color). Winter fur on back beautiful straw-gray with a pinkish rust tinge (avellaneous).

Length of skull 45-49 mm (M. 46.8); condylobasal length 41-43.5 mm (M. 43); zygomatic width 21-24 mm (M. 23.1); interorbital distance 3.2-4.7 mm (M. 4.2); width of skull at level of auditory meatus 22-24 mm (M. 23.2); length of upper tooth row 8.5-9.5 mm (M. 9).

Body length 180-215 mm; hind feet 29-33 mm; ear 21-26 mm.

ADDITIONAL DESCRIPTION. Color of summer fur on back ocher-rust-gray of varying intensity (generally cinnamon-buff) with some grayer and rustier tones (cinnamon, clay color). Fur on top of head of the same color as on back; rust-brown-ocher tones more marked on top of head and back. Color of flanks lighter than that of back, more yellowish ocher. Color of cheeks the same. Eyes surrounded with ash-gray fur. Belly whitish, but the lead-gray bases of hair show through the white tips. A pale yellowish transverse stripe on the chest between the anterior legs. An indistinct pale yellowish rust stripe (pale pinkish-buff) runs from the transverse stripe to the middle of the belly.

Inner side of ear with whitish gray hair; outer side also with such hair, but more sparsely. Light margins of ears little marked and undistinct.

Legs with whitish hair with a dirtier tinge on the soles. Claws horny brown.

83 The vibrissae consist of a mixture of whitish and brownish black hair; tips of the longest vibrissae white.

General color of winter fur on back straw-gray with a pinkish tinge (avellaneous). Top of head grayer, with an ash tone. Flanks with a weak light yellowish tinge (pinkish-buff). Belly white, sometimes slightly yellow. Color of back uniform without the brown tinge of the gray ground color of the winter fur of other forms. A brown tone present only along the midline of the back, where there are many hairs with gray-brown tips.

SYSTEMATIC NOTES. I.E. Gray (1867) described a species with the name Ogotoma pallasii. He wrote as follows "Ogotoma. Skull: the orbits very large; space between the orbits narrow; nose narrow, bent down".

"Ogotoma pallasii (Lagomys ogotoma Cuvier, Waterh., Glir. 17. Lepus ogotoma Pallas, Glires, 30, t. 3, 4a, f. 16 a.) B.M.".

Gray did not indicate the terra typica for his Ogotoma pallasii in this fragmentary description. After examining the holotype of O. pallasii at the British Museum, B.S. Vinogradov wrote that this species is very similar to O. pricei but larger and differing in its narrower interorbital space (3 mm). The interorbital space becomes narrower with age. It is therefore possible that an old specimen of pricei was used as holotype for "O. pallasii".

As no terra typica was given for "Ogotoma pallasii", as there is no description of this species, and as Gray partly confused his new species with O. daurica Pall. (=Ogotona Pall.), we think that "Ogotoma pallasii" is best considered as a doubtful synonym of O. pricei.

The Mongolian pika is closely related to O. daurica, O. curzoniae, O. ladacensis and O. rufescens, and forms with them a systematic group. It differs slightly from O. daurica in characters of its bony palate.

In Glover Allen's opinion (1927) O. pricei differs from O. daurica in the better development of the bare, black, calluses of the toes, and in its shorter claws in the hind feet. These characters are not very marked and not always constant, but they are certainly correct.

O. Thomas (1924) (A New Pika from Altai, Ann. and Mag. of Nat. Hist. ser. 9, Vol. XIII, pp. 163-164) described a new species from Taldura in the southeastern* Altai, west of the Chuya Steppe. He considers O. sushkini as closely related to O. pricei, but differing in its richer color of the summer fur. Color of fur of O. sushkini according to
84 Thomas saturated, rust-ocher-yellowish (cinnamon-buff); this color becomes darker on the back because of the dark hair tips; fur on neck and lower part of back light and rich. Belly with a strong admixture of rust-yellow tones. Top of head grayer than back.

Length of body and head 200 mm; hind feet (measured on pelt) 28 mm; ear 18 mm.

Skull length 48.3 mm; condylo-incisive length 44 mm; zygomatic width 23 mm; nasals 15.3×6; interorbital space 4.8 mm; width of skull in region of bullae osseae 22.4 mm; length of bullae osseae 11.7 mm; length of upper row of molars 9.2 mm.

O. sushkini Thos. undoubtedly is identical with O. pricei, according to all characters.

We are still unable to decide whether Price's pika from the Chuya Steppe is a separate subspecies, for lack of material. Winter specimens from river Chuya, collected by Romanov in January-February 1841 (in the collection of Professor Eversman) do not differ from Mongolian winter specimens of O. p. pricei Thos. More material will, possibly, show that the Chuya summer specimens of O. pricei have a richer color than the Mongolian ones. In this case, the subspecific name of O. p. sushkini will be maintained.

GEOGRAPHICAL DISTRIBUTION. Given in detail in the general survey. This form occurs throughout the wide eastern range of O. pricei except in the western parts of this range, i.e., the Karkaralinsk Region and Sary-Su (vide supra).

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* O. Thomas (1924) erroneously recorded this species from the northeastern Altai. Pikas of the Pricei type are completely absent in this part of the Altai.

324. **Ochotona (Ochotona) pricei** subsp. nov. Price's Semipalatinsk pika

1932. Ochotona pallasii Kuznetsov, B. A., Gryzuny Semipalatinskogo okruga Kazakhstana (Rodents of the Semipalatinsk District, Kazakhstan), Byulleten' Moskovskogo obshchestva ispytatelei prirody, XLI (1-2): 116 [near river Tokradzh (Tokrau), former Kedei subdistrict, former Karkaralinsk County].

1932. Ochotona pricei Thomas subsp. nov. Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Material on the Rodent Fauna of Soviet Central Asia), Trudy Zoologicheskogo instituta Akademii Nauk, I, pp. 51-52.

TYPE LOCALITY AND DEPOSITION. No. 19987 (250, 1929), collection of adults, 21 Jul. 1928, Kedei subdistrict, former Karkaralinsk County, former Semipalatinsk Region. Type in the ZMAN collection.

MATERIAL EXAMINED: 2 pelts and skull fragments.

DIAGNOSIS. General tone of summer fur on back dull grayish-brown with a slight yellowish tinge (general impression: drab). Black with slight speckling caused by blackish brown hair tips. Color of top of head like that of back; top of head in Mongolian specimens usually more reddish than back. Flanks and lower part of back with a more or less marked ocher tinge, ground color of flanks gray (smoke-gray). Hair on belly dirty whitish with a slight ocher-yellow tinge; bases of hair on belly gray. Winter fur* generally similar to summer fur, but more intensely ocher-brownish (buff-brown); dark brown speckles more marked.

85 SYSTEMATIC NOTES. This subspecies differs very sharply from Mongolian specimens of O. pricei. A.I. Argyropulo (1932) mentions some cranial differences between Semipalatinsk and Mongolian specimens. The skull of the Semipalatinsk specimens is smaller, the rostrum more massive and shorter, tympanic bones larger. These differences are based on only one defective skull. It is therefore more than doubtful whether they are constant.

I am not naming the Semipalatinsk form as a subspecies, because this has already been done as far as I know by A.I. Argyropulo in the manuscript of his work on pikas of the U.S.S.R. in the "Fauna of the U.S.S.R."

GEOGRAPHICAL DISTRIBUTION. Discussed above.

Subgenus **Conothoa** Lyon

1904. Conothoa Lyon M. W. Classification of the Hares and their Allies, Smithsonian Miscellaneous Collections, Vol. I, parts 3-4, p. 438.

Skull rather massive, not flattened in the interorbital and frontal regions in most species, where the skull is often convex in profile. Frontal fenestrae often well developed. Interorbital space broad. Orbits of medium size. Triangular fenestrae of rostrum large and angular. Structure of palatine and incisor foramina varying: palatine and incisor foramina fused and vomer ventrally free in O. roylei, O. macrotis, O. wollastoni, O. nubrica; structure of these foramina intermediate in O. rutila because they are connected by a narrow slit; palatine and incisor foramina separate and vomer almost covered by the premaxillaries in O. erythrotis and O. gloveri. Color of summer fur, and that of winter fur in some specimens, often with well marked rust-red tones. Pads of digits well developed. Vibrissae long, to 95 mm.

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* Described from specimen No. 17422 in the ZMAN.

The species inhabits high mountains.

Type of Subgenus: Ochotona roylei Ogilby.

This subgenus contains also the following species: Ochotona macrotis Günth., O. rutila Severtz., O. erythrotis Büchn., O. gloveri Thos., O. wollastoni Thos., O. nubrica Thos.

GEOGRAPHICAL DISTRIBUTION. Pamir Mountains, Altai, Ferghana, Gissar Range, Dzhety-Su Mountains, Ladakh, Himalayas (to 20,000 ft), Tibet and Kansu.

154. Ochotona (Conothoa) macrotis Günther (1875). Large-eared pika or Indian pika.

1875. Lagomys macrotis Günther A., Description of Some Leporine Mammals from Central Asia, Annals and Magazine of Natur. History, Vol. XVI, ser. 4, No. 93, p. 231.

1914. Ochotona sacana Thomas O., On small Mammals from Djarkent, Annals and Magazine of Natur. History, p. 572 (vicinity of Przheval'sk).

1925. Ochotona alpinus (partim!), Shnitnikov, V. N., Dzhety-Su (Dzhety-Su), p. 129.

1928. Ochotona rutila Vinogradov B. S., Mlekopitayushchie (Mammals), Sbornik: "Trudy Pamirskoi ekspeditsii" (Reports of the Pamir Expedition), Issue VIII Zoologiya, p. 8 (partim!). 86

1932. Ochotona macrotis Argyropulo A. M., Materialy po faune gryzunov Srednei Azii, Pishchukhi Srednei Azii (Materials on the Rodent Fauna of Soviet Central Asia. Pikas of Soviet Central Asia). Trudy Zoologicheskogo instituta Akademii Nauk, II, pp. 42-45.

1933. Ochotona macrotis Vinogradov B. S., Mlekopitayushchie SSSR (Mammals of the U. S. S. R.), p. 81.

1936. Ochotona macrotis Shnitnikov V. N., Mlekopitayushchie Semirech'ya (Mammals of Dzhety-Su), pp. 258-259.

NAMES: The large-eared pika (English); Langohriger Pfeifhase (German).

LOCAL NAMES: Tiin-tshkan (Kara-Kazakh, Kara-Kirghiz),

TYPE LOCALITY AND DEPOSITION: A. Günther (1875) reports that he described his new species from 2 specimens. The first (in a very bad condition) is kept at the British Museum without an accurate label since 1844. The other, which has to be considered as the holotype, was caught by Biddelph on river Doba (Central Tibet, 31° N and 87° E). W. T. Blanford (Scientific Results of the Second Yarkand Mission, Mammalia, 1879, p. 76) stated that the type of macrotis was caught near Duba, while A. Günther records it from Doba. According to Blanford, Duba lies at the northwestern outskirts of the Kunlun Ranges, on the way from Yarkand to Kugiar, not far from Yangi-Divan. I find it difficult to judge who is correct about the type locality of this species. These two localities are zoogeographically closely related. It is more likely that Doba in Central Tibet is the terra typica of macrotis, in our opinion.

PRINCIPAL FIGURES: 1) Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Materials on the Rodent Fauna of Soviet Central Asia), Trudy Zoologicheskogo instituta Akademii Nauk, I, 1932, p. 43, fig. 4 (skull dorsal, ventral and lateral); 2) Vinogradov B. S., Mlekopitayushchie SSSR (Mammals of the U. S. S. R.) 1933, p. 81, fig. 75 (a) (skull dorsal).

MATERIAL EXAMINED: 19 pelts and skulls.

DIAGNOSIS. Skull of average size. Length reaching 47 mm. Interorbital space flat and broad (5.2-6 mm). Anterior third of nasals little widened; lateral margin of posterior third of nasals almost parallel; posterior quarter of nasals depressed. Posterior end of nasals rounded. Anterior part of frontals with oval elongated frontal fenestrae. Vomer free, not covered ventrally by the premaxillaries; which diverge anteriorly at an angle. Palatine and incisor foramina fused (Figures 40- 43).

Vibrissae mixed black and white, length 55-70 mm. Ears rather long, to 31 mm.

Color of summer fur on back of various shades of grayish brown with an ocher tinge. Winter fur of back dense, fluffy pale gray with a straw-yellow tinge.

Body length to 200 mm; posterior feet 32-34 mm.

ADDITIONAL DESCRIPTION. Color of summer fur on back of various shades of grayish brown with a more or less marked ocher tinge, general tone drab with an admixture of buff-brown, sometimes saccardos-umber or tawny-olive. Rusty tones intermediate between pinkish cinnamon and cinnamon-buff distinct on head, cheeks and flanks; occiput with a generally pale rust-yellow (intermediate between light pinkish cinnamon and pinkish buff) indistinctly marked transverse stripe. Belly dirty-whitish, sometimes with a slight yellowish tinge.

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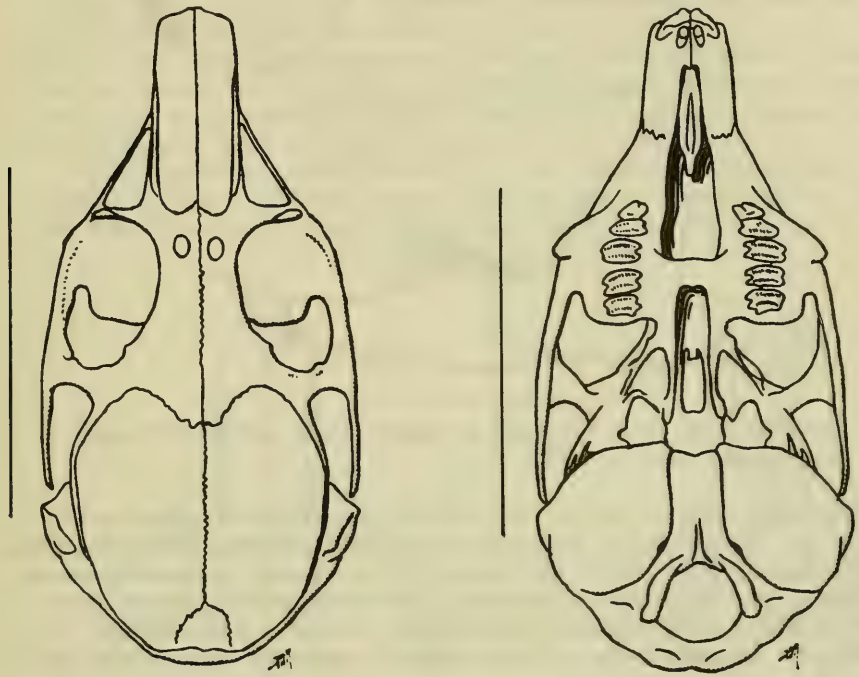

FIGURES 40, 41. Skull of large-eared pika, Ochotona macrotis Günther, dorsal and ventral. No. 17950 ♀, Pamir, Kara-Kul, 14 June, 1928

Drawing by Yu. A. Kostylev

88 Winter fur on back dense, fluffy, generally pale, grayish with a straw-yellow tinge (avellaneous with pinkish buff and cinnamon-buff tinge, Ridgway, 1912). Rust tones (cinnamon-buff) better marked on top of head. Cheeks with an ash-gray tinge; fur on flanks yellowish ocher (intermediate between pinkish buff and cinnamon-buff). Ears whitish. Inner side of anterior margin of ears dark ash-gray. Belly pure white; bases of hair on belly deep gray.

SYSTEMATIC NOTES. O. Thomas (1914) described Ochotona sacana from seven specimens from the vicinity of Przhevalsk. V.N. Shnitniknov (1936) assumes that these specimens were caught in Terskei Ala Tau, perhaps in the valley of the Karakol river near which Przhevalsk lies.

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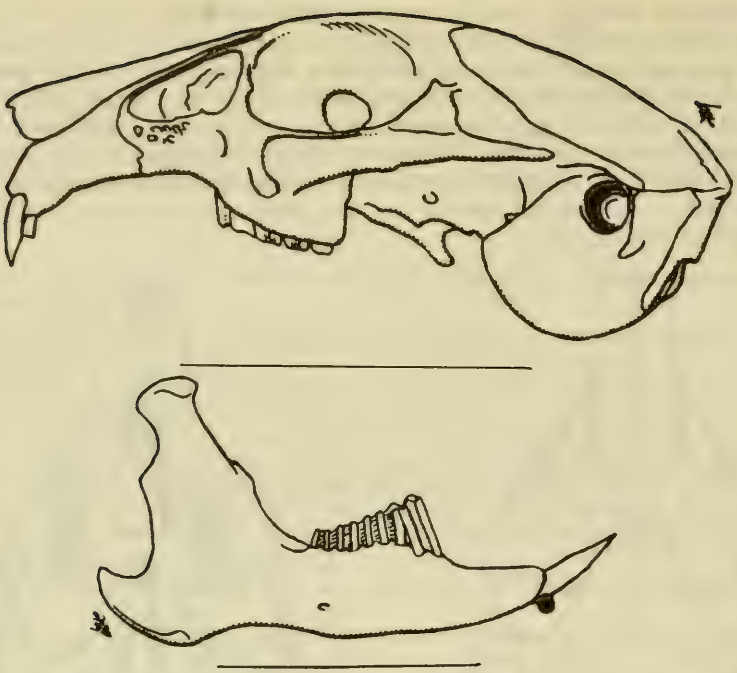


FIGURES 42, 43. Lateral view of skull and mandible of large-eared pika, Ochotona macrotis Günther, No. 17950.

88 O. Thomas remarks that O. sacana is very closely related to O. macrotis. Series of O. sacana can be easily distinguished, according to him, from true macrotis (in winter fur) by the rust (cinnamon) tones of the flanks and lower part of the back, and by the more blackish outer parts of the ears. The measurements of O. sacana according to Thomas are: length of body and head 200 mm; anterior feet 33 mm; ear 28 mm.

Maximum skull length 47 mm; condylo-incisive length 44 mm; zygomatic width 22.5 mm; nasal bones 16×5.5; interorbital space 5.3 mm; width of skull at level of auditory meatus 18 mm; palatine foramina 13.5×4.7; width of palatine bridge 1.8 mm; length of upper tooth row (alveoli) 9 mm (type caught in December 1913).

According to Thomas's description and his remark that O. sacana and O. macrotis are very closely related (for instance, there are no cranial differences between them) we consider that the identity of macrotis and sacana as definitely established (cf. A.I. Argyropulo, 1932).

We have not enough material to prove that sacana differs from the nominal race sufficiently to be considered as a subspecies of macrotis. However, this is probably correct if such an expert mammalogist as O. Thomas thinks so.

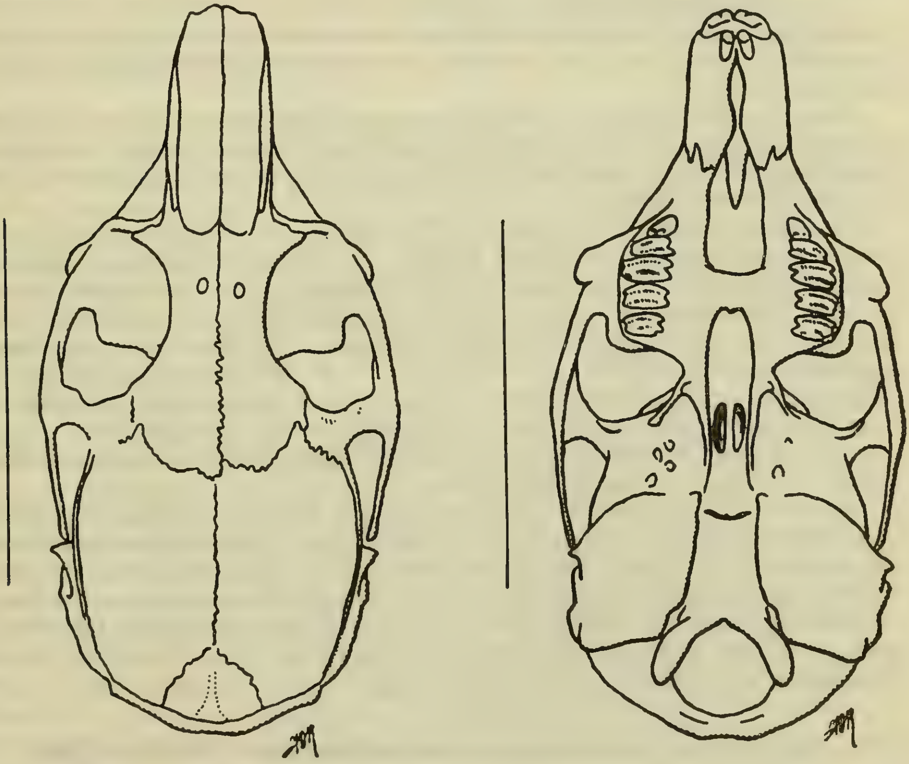
The skull of Ochotona macrotis differs from that of O. rutila in the following characters: 1) generally smaller size and weight; 2) steeper frontal contour; 3) the short rostrum; 4) presence of frontal fenestrae; 5) broader connection between the palatine foramina.

O. macrotis, O. rutila, and O. erythrotis form a group well defined by some characters and the general form of skull. O. erythrotis is found in Kansu and in the mountains of northeastern Tibet, and Burhan-Budda Range.

The skull of O. erythrotis is morphologically intermediate between that of O. rutila and macrotis; there are frontal fenestrae in erythrotis which are absent in rutila. The structure of the palate in erythrotis differs rather sharply, erythrotis belongs to the subgenus pika (as understood by Thomas) according to the following characters: premaxillary processes partly covering the vomer so that it is little visible ventrally (see Figures 44, 45).

89 Finally, it should be mentioned that the Himalaya-Tibet O. roylei Ogilby is very small, its color markedly different from that of macrotis and rutila. Its skull resembles that of macrotis (on a small scale); the structure of the palate is the same as in macrotis.

GEOGRAPHICAL DISTRIBUTION. The large-eared pika occurs in Russia on Peter the Great Range (2980 m) and in eastern Pamir. According to recent observations of M.P. Rozanov (1935) O. macrotis occurs



FIGURES 44, 45. Skull of Ochotona erythrotis Büchner (dorsal and ventral), No. 1500 ♂, Burhan-Budda Range. N.M. Przheval'skii, ZMAN collection

Drawing by Yu. A. Kostylev

throughout eastern Pamir. It was observed near the Pamir station and near Kyzyl-Rabat (at an altitude of 4000 m). There are specimens from Lake Range-Kul and Kara-Kul in the ZMAN collection. O. macrotis also occurs in mountains near Karakol (Przhevalsk), on the Terskei Ala Tau, in the mountain region to the south of Naryn and in central Tien Shan. V.N. Shnitnikov (1936) found it in the valley of river Kuelyu (Kuilyu), in the Sardzhas Range, and also on the Kargalyk Pass connecting the Toguz-Torau with the valley of river Alabuga, i.e., not far from the Fergana frontier. A.I. Argyropulo (1932) records specimens from the rivers Tandyk and Terek-Su (south of Gulcha)in the ZMAN museum.

O. macrotis is thus sporadically distributed in the mountain region
90 of Central Asia in isolated colonies. V.N. Shnitnikov (1936) writes the following about Dzhety-Su: "The distribution of O. macrotis (like O. rutila) in this region is rather strange. It lives north of Issyk-Kul, then it is found along the Alexander [Kirghiz] Range, then westward and turns south in western Tien Shan, carefully bypassing the boundary of Dzhety-Su. Then it turns again east and south, and occurs from the Alai and Pamir westward to the Gissar Range. The distribution of O. macrotis in the southwestern corner of Dzhety-Su, is wedged into the range of O. rutila.

"The ranges of the two species ought, therefore, to overlap, or at least adjoin each other. We should look for such places in the region south of Issyk-Kul, in the Dzhumgal or Kabak Mountains, and perhaps also in the Susamyr Range."

Outside of the U.S.S.R., the large-eared pika occurs on the northeastern Kunlun, in the mountains between Yarkand and Kushar, in the mountains along Raskam-Darya near Ley (on the Indus), in Ladakh, near Shushal and in Central Tibet (Doba).

MODE OF LIFE. According to V.N. Shnitnikov (1936) O. macrotis lives mainly in screes in spruce forests. It is very numerous in some places, for instance in the valley of river Kuelyu. V.N. Shnitnikov found it here on screes in the spruce forest. He found many cut leaves of Corydalus sp. spread for drying on stones. He found also very many cut leaves of Astragalus frigidus. V.N. Shnitnikov did not find "haystacks", and he thinks that O. macrotis deposits hay in storerooms among stones. The pikas were rather cautious and cried rarely.

M.P. Rozanov (1935) writes that he saw pikas living in crevices among stones, in burrows near Kyzyl-Rabat.

"Near the Kyzyl-Rabat Mountain Pass, we saw a rock with many pika excrements and stores of dry grass in the cracks. We did not see the animals themselves. We caught one of the animals in the Nimkhan plot, near the estuary of river Mats. We saw a large colony in large screes near the river Mats dam, and caught some. The pikas live everywhere together with the Pamir high-mountain vole (Alticola argentatus) and the gray hamster (Cricetulus migratorins)."

155. Ochotona (Conothoa) rutila Severtzov (1873). Red pika

1873. Lagomys rutilus Severtsov, N.A., Vertikal'noe i gorizontal'noe raspredelenie turkestanskikh zhivotnykh (Vertical and Horizontal Distribution of Turkestan Animals): Izvestiya Obshchestva lyubitelei estestvoznaniya, VIII (2):83.

1879. Lagomys rutilus Severtsov N. A., Zametki o faune pozvonochnykh Pamira (Notes on the Vertebrate Fauna of the Pamir), Zapiski Turkestanskogo otdeleniya Geograficheskogo obshchestva, I, p. 64.

1927. Ochotona rutila Kashkarov D. N., Rezul'taty ekspeditsii v raion ozera Sary-Chilek (Results of an Expedition to Lake Sary-Chilek), p. 101.

1930. Ochotona rutila Vinogradov B. S., Rukovodstvo k opredeleniyu gryzunov Srednei Azii (Key to Rodents of Soviet Central Asia), p. 49.

1932. Ochotona rutila Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Materials on the Rodent Fauna of Soviet Central Asia), Trudy Zoologicheskogo instituta Akademii Nauk, I, pp. 37-42.

1935. Ochotona rutila Vinogradov B. S., Otryad gryzunov (order Rodentia), Sbornik: "Zveri Tadzhikistana" (Animals of Tadzhikistan), Izdatel'stvo Akademii Nauk, pp. 250-251.

91 1935. Ochotona rutila Rozanov M. P., Mlekopitayushchie Pamira (Mammals of the Pamir), Tadzhikskaya kompleksnaya ekspeditsiya, Issue XXXII, p. 55.

1936. Ochotona rutila Shnitnikov, V. N., Mlekopitayushchie Semirech'ya (Mammals of Dzhety-Su), pp. 254-256.

NAMES: The red pika (English); Der rote Pfeifhase (German).

LOCAL NAMES: tyni-tyshkan (Kazakh, Kirghiz).

TYPE LOCALITY AND DEPOSITION: Type collected in 1867 by N. A. Severtsov in mountains near Vernyi — now Alma-Ata (at an altitude of 7000-8000 ft). Type number S. 11,074, kept in the Moscow Zoological Museum.

PRINCIPAL FIGURES: 1) Schäff E., Ueber Lagomys rutilus, Zoologische Jahrbüch., Bd. II, 1887, S. 65-72; 2) Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Materials on the Rodent Fauna of Soviet Central Asia), Trudy Zoologicheskogo instituta Akademii Nauk, I, 1932, pp. 37-42, fig. 2 (foramina incisiva); p. 39, Fig. 3 (skull dorsal, ventral and lateral); 3) Vinogradov B. S., Gryzuny (Rodents), Sbornik: "Zveri Tadzhikistana" (Animals of Tadzhikistan), Izdatel'stvo Akademii Nauk, 1935, p. 250, fig. 85; 4) Shnitnikov, V. N., Mlekopitayushchie Semirech'ya (Mammals of Dzhety-Su), 1936, p. 254, fig. 67 (map of geographical distribution).

MATERIAL EXAMINED: 15 pelts and skulls.

DIAGNOSIS. Skull relatively large; in fully grown and old specimens, its length is often more than 48 mm, sometimes 52 mm. Interorbital space broad, 5.7-6.9 mm, rather flat, slightly convex in the middle of profile, without any lateral crests. Anterior third of nasals with marked spoon-shaped widening. Lateral contours of nasals gradually narrowing posteriorly; each nasal ends in a separate curve posteriorly. Frontals without fenestrae. Premaxillaries in palatine region close together but not fused. The vomer is therefore completely visible ventrally, and the incisor and palatine foramina are not separated, but connected by a narrow space (Figures 46-49).

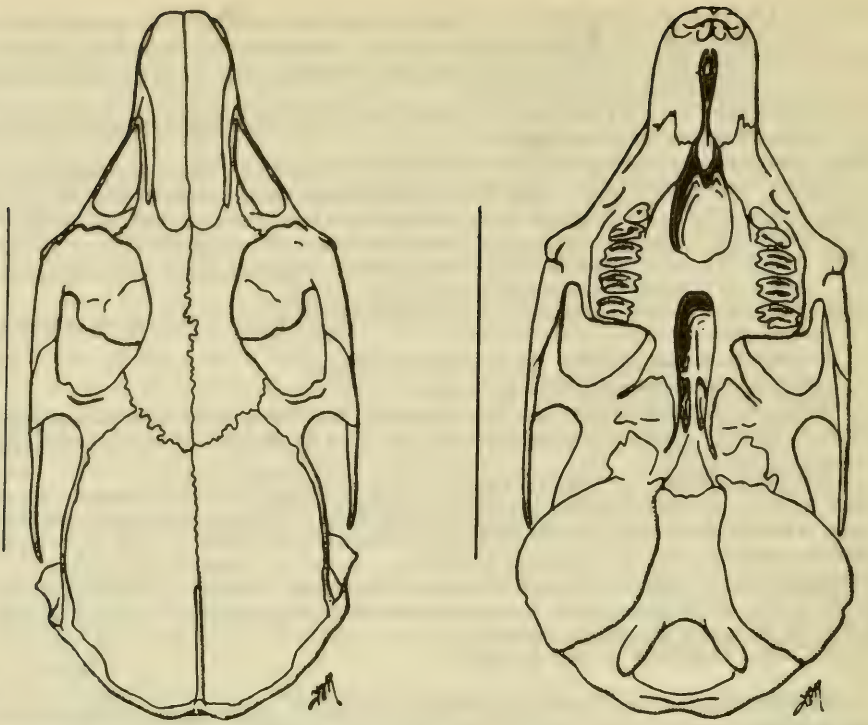
Vibrissae long, 80-94 mm; some of them dark brown, the others white; the longest vibrissae have dark bases and broad white tips. Soles whitish or grayish white. Ears without marked light borders.

Color of summer fur on back (see pl. I, upper illustration) rich rust-reddish (intermediate between cinnamon and sayal-brown, Ridgway, 1912, pl. XXIX); flanks more yellow with a cinnamon-buff tinge; a broad yellowish white collar behind the ears; belly whitish with a rusty tinge; a dull rust-red transverse stripe on the chest. Winter fur ash-gray with blackish brown speckling caused by the brown-blackish hair tips.

Body length 215-230 mm; posterior feet 35-38 mm; ear 25-28 mm.

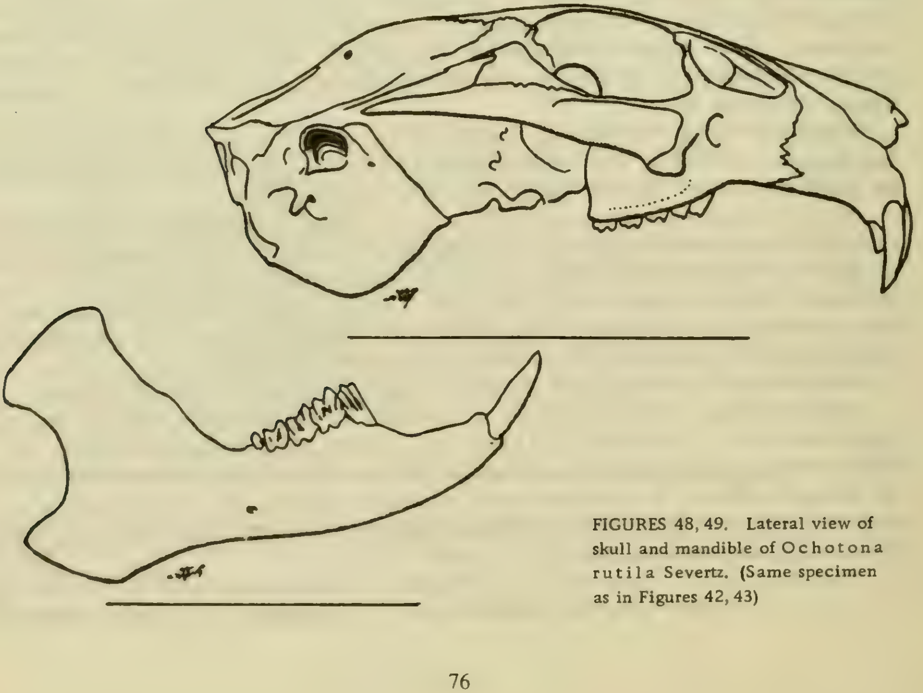
ADDITIONAL DESCRIPTION. The skull of the red pika differs sharply from that of O. (Pika) alpina Pall. in the following characters: 1) skull more convex dorsally in profile (especially in the interorbital space); 2) longer orbits; 3) anterior part of nasals wider; 4) bullae osseae shorter, their form sharply different from that of O. alpina; 5) different form of palatine foramina.

The skull of O. erythrotis Büchn. differs markedly from that of O. rutila in the following characters: 1) presence of frontal fenestrae;



FIGURES 46, 47. Skull of red pika, Ochotona rutila Severtz. 24 Aug. 1929. Alexander [Kirghiz] Range, collection of the Moscow Zoological Museum

Drawing by Yu. A. Kostylev



FIGURES 48, 49. Lateral view of skull and mandible of Ochotona rutila Severtz. (Same specimen as in Figures 42, 43)

93 2) different form of nasals; 3) different structure of palate. The external appearance of O. erythrotis resembles that of rutila (especially the color of the summer fur). These species belong to the same subgenus.

Color of summer fur on top of head and on back intense rust-red (intermediate between cinnamon and sayal-brown). Cheeks and region around the eyes of the same color. Nose anteriorly more yellowish.

A pale, indistinct, rust-yellow stripe behind the eyes in the occipital region; a well developed collar behind the ears which is narrower, and less well marked between the ears. Color of flanks more pale and yellowish, intermediate between cinnamon-buff and pinkish buff. A dull rust-red stripe on the chest between the forelegs. Chin and top of head white; belly whitish with a slight rust-red tinge which is especially well marked in the midline of the belly. Inner side of ears with grayish white hair; a tuft of yellowish white hair at the anterior inner side of the base of the ears. Outer side of ears grayish. Paws with rust-red hair. Feet whitish, with a slight rust tinge dorsally, soles whitish gray.

General tone of winter fur rather pale, gray with blackish brown speckling caused by the black-brown tips of hairs. Bases of long winter hair deep slate-gray or blackish. Color of flanks like that of back (slightly duller and grayer); belly whitish; gray bases of hair visible through hair tips on belly. No rust-red stripe on chest, the color of the chest is as whitish as that of the belly.

Color of young on back light ocher with reddish tones on head and flanks.

GEOGRAPHICAL DISTRIBUTION. N.A. Severtsov (1873), who was the first to collect and describe this species, writes as follows: "A young and an old specimen were caught in late May 1867 in the mountains near Vernyi [Alma-Ata] at an altitude of 7000-8000 ft. An old and molting specimen was caught previously, in the ravine of river Kara-Bury to the south of Aulie-Ata [Dzhambul]* (in late June 1864) at an altitude of about 6500 ft." A.I. Argyropulo (1932) records the localities where the specimens of the ZMAN collection were caught as follows: the Kirghiz (Alexander) Range, ravine of the river Tuyuk (Shnitnikov); vicinity of the Alma-Ata (the Almaatinskoe Lake); Alai (northern slope of Pengalbai Mountain Pass (Molchanov)); the Gandakush landmark, 64 km to the south of Fergana (Zhinkin); near the river Kshtut-Dar'ya**; Shaar Mountain at an altitude of 7000 feet (Shakhrizyabs); Marguzar-Kul; upper reaches of river Shink† ; the former Samarkand County (N.A. Severtsov); the Gissar Range on Iskander-Kul (Russov); Pamir (Russian-German expedition).

94 There is a good series from the Kirghiz (Alexander) Range in the Moscow Zoological Museum. D.N. Kashkarov (1927) found this species in large numbers near Lake Sary-Chilek, at an altitude of 1925 m in the northern part of the former Namangan County between spurs of the Chatkal Range.

According to N.P. Rozanov (1935) this species was found in the western part of the Pamir, on rocks near the Shid settlement on the Pyandzh. It apparently does not occur in the eastern Pamir. According to V.N. Shnitnikov (1936) the red pika occurs in the Ala-Tau, on the Alexander

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* On the Kirghiz (Alexander) Range.

** A tributary of river Zeravshan.

† In the Gissar Range.

(Kirghiz) Range and on the northern slope of the Kungei Ala Tau. V.N. Shnitnikov has records of this species from the southern slope of this range, but he has no specimens from this locality. The red pika does not occur to the south of Lake Issyk-Kul according to him. D.N. Kashkarov's record of O. rutila from the Terskei Ala Tau seems erroneous, as this region is inhabited by O. macrotis. The range of O. rutila thus includes the following localities: the Zeravshan Mountains; Gissar Range; Alai Range; the wester Pamir; Chatkal Range on the Kirghiz (Alexander) Range; Trans-Ili Ala Tau; Kungei Ala Tau.

V.N. Shnitnikov mentions a species of pika from the Dzungarian Ala Tau (valley of river Kora, Kyzyl-Agach). However, no specimens were caught in this region, and it is therefore not known which species occurs there.

MODE OF LIFE. There are very few data on the biology of this species. A few interesting data are given by V.N. Shnitnikov (1936). The red pika generally occurs on high mountains (above 2000 m) and screes. Its distribution is sporadic. It may be present in one ravine and be absent in another, although conditions in both are the same.

According to V.N. Shnitnikov, this species occurs from the middle of the spruce forest belt to the subalpine meadow region. It does not occur at higher altitudes in the juniper region (Juniperus sabina, in the mountains near Alma-Ata). On the other hand, N.A. Severtsov (1873) states that the red pika "lives among juniper". V.N. Shnitnikov's statement seems therefore not quite accurate.

Shnitnikov writes: "Pikas move with great agility among screes and heaps of stones, giving the impression of moving shadows. Although it is quite natural that not the slightest sound should be heard even when the animals move quite close, the absolute silence of their movements seems unnatural. If one stands or sits quietly among the stones, the pikas approach quite close. I know of a case in which an animal was killed with a whip."

The red pika is very quiet. V.N. Shnitnikov did not hear its voice even once.

V.N. Shnitnikov writes: "The pikas are diurnal. Sometimes they can be observed throughout the day. However, they are most active at dusk,
95 and feed and carry grass in the morning, after sunrise. However, they are less active than in the evening.

"During the day, they are seen only accidentally, because they generally lie motionlessly on a stone like a sphinx. Sometimes they stretch their hind legs, and are then difficult to see. They are spotted only when approached closely and they run away among the stones".

The red pika prepares food stores and hay for the winter, which it hides under stones. It does not make "haystacks".

O. rutila occurs sporadically and rarely among stones along the coast of Lake Issyk Kul (at an altitude of 1750 m); and in the Issyk Kul woodland in the Alma-Ata State Reserve, about 45 km east of Alma-Ata. The pikas inhabit stone heaps and breccia along the western coast of Lake Issyk Kul, and also breccia near the Maloe or Nizhnee Lake.

O. rutila occurs sporadically also in small numbers in screes along the road to the Talgar Mountain Pass at 2200 m in subalpine meadows. Juniper and dwarf birch trees grow where pikas were found.

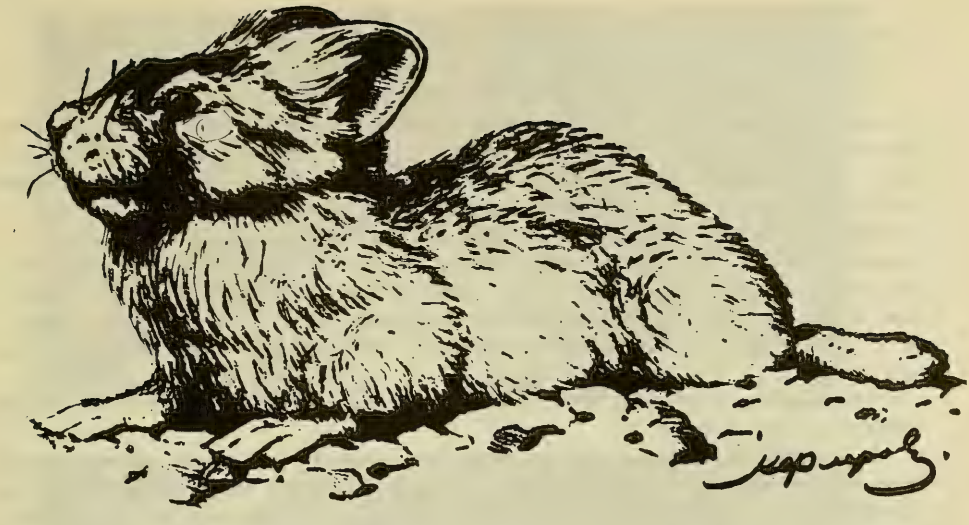

FIGURE 50. Red pika, Ochotona rutila Severtz.

Drawing by K. K. Flerov

I had the opportunity of observing a single pika for a long time on 29 July 1938, between 1 and 5 p. m. The animal was very active. With graceful and silent jumps, it hopped over the stones, climbing on stone heaps to collect hay. After a few minutes, it entered its burrow in a crevice among stones with a plant it had just cut (usually Epilobium or a branch of wild cranesbill). The plants were piled near the entrance of the burrow. There were several handfuls of fresh grass under and near a stone.

96 It was very interesting to watch the graceful movements of the beautiful animal. After it reached the burrow, it stopped, examined the people sitting near it, moved its long vibrissae and calmly observed the intruders with large shining black eyes. It swiftly jumped into a crevice among the stones to deposit the newly cut plant. The animal is very trusting, and lets itself be approached to 3-4 steps (pl. II).

Some sporadic colonies, each of a few individuals, were found among stones along the coast of the Bolshoe Almatinskoe Lake (in the Trans Ili Ala Tau, at 2800 m).

A.I. Argyropulo (1932) thinks that the young are born in the first ten days of June (in Lake Iskander-Kul). This seems too late; the young are probably born in May.

We have few data on the molt of this species. In his book "Mammals of Dzhety-Su" (Mlekopitayushchie Semirech'ya), 1936, pp. 256-257, V.N. Shnitnikov gives contradictory data. In his opinion, "the pika enters the winter in its reddish fur". This statement is contradicted by his remark that the pikas wear a very long and dense light gray fur* in early spring, which is apparently correct.

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* In Shnitnikov's opinion, this is contradicted by the statement of N. A. Severtsov that he caught a fiery red specimen in late May. N. A. Severtsov has not mentioned such a specimen. On the contrary, he mentions a specimen caught in late May wearing its old fur and strongly molting. This molting specimen is in the collection of the Zoological Museum of the Moscow University.

This statement is also contradicted by Shnitnikov's remark that "the complete molt from reddish fur to gray fur takes place in late autumn".

If this is true, how do the pikas "enter winter" in a reddish fur?

A.I. Argyropulo (1932) observed that intense molting on the head (as in other species of Ochotona) was observed in specimens caught in May. Short-haired reddish patches are clearly visible on the worn, long winter fur. The new fur is clearly seen on the head and flanks. Such a specimen is in the collection of the Zoological Museum of the Moscow University caught on 22 May 1922 on the Kirghiz (Alexander) Range. A specimen caught by N.A. Severtsov near Alma-Ata (late May 1867, Old Style) was in strong spring molt. Shreds of rust-red fur are clearly seen on top of the head, the anterior part of back, chest, flanks and partly on the legs. A.I. Argyropulo (1932) observed that the lower part of back molts last as a rule.

The beginning of molt into winter fur could already be seen in specimens caught in late August.

It is difficult to describe the molt from so little material. It apparently takes an opposite course to the spring molt, i.e., the lower part of the back
97 molts first. A.I. Argyropulo (1932) observed that patches of winter fur appeared all over the body without any regular "molting foci". In my opinion, Argyropulo's observations gave negative results for lack of material*.

We have no data on the winter life of the red pika.

The ermine is one of the most important enemies of this rodent according to V.N. Shnitnikov (1936). The pikas disappeared from Bolshaya Almaatinka (near Alma-Ata) because they were hunted by the numerous ermines. After the extermination of the pikas in Bolshaya Almaatinka the ermines began feeding on the numerous voles (Alticola worthingtoni and Evotomys frater).

Species of the Ochotona pusilla and O. thibetana group

The species of this group should probably be considered as a separate subgenus (vide infra).

The characters of the group are as follows:

Skull in interorbital-frontal region slightly convex. Frontal fenestrae absent. Interorbital space moderately wide. Orbits small. Rostrum very short.

Palatine and incisor foramina of varying form. They are connected by a narrow slit in O. pusilla and in O. thibetana both foramina are fused.

Color of summer fur very peculiar, a rather dark gray-brown, grayer in some species, with marked straw speckling on flanks and trunk. Belly whitish gray.

Vibrissae very short, not more than 45 mm long.

The species inhabit valleys in steppes and plateaus.

Type species: Ochotona pusilla Pall.

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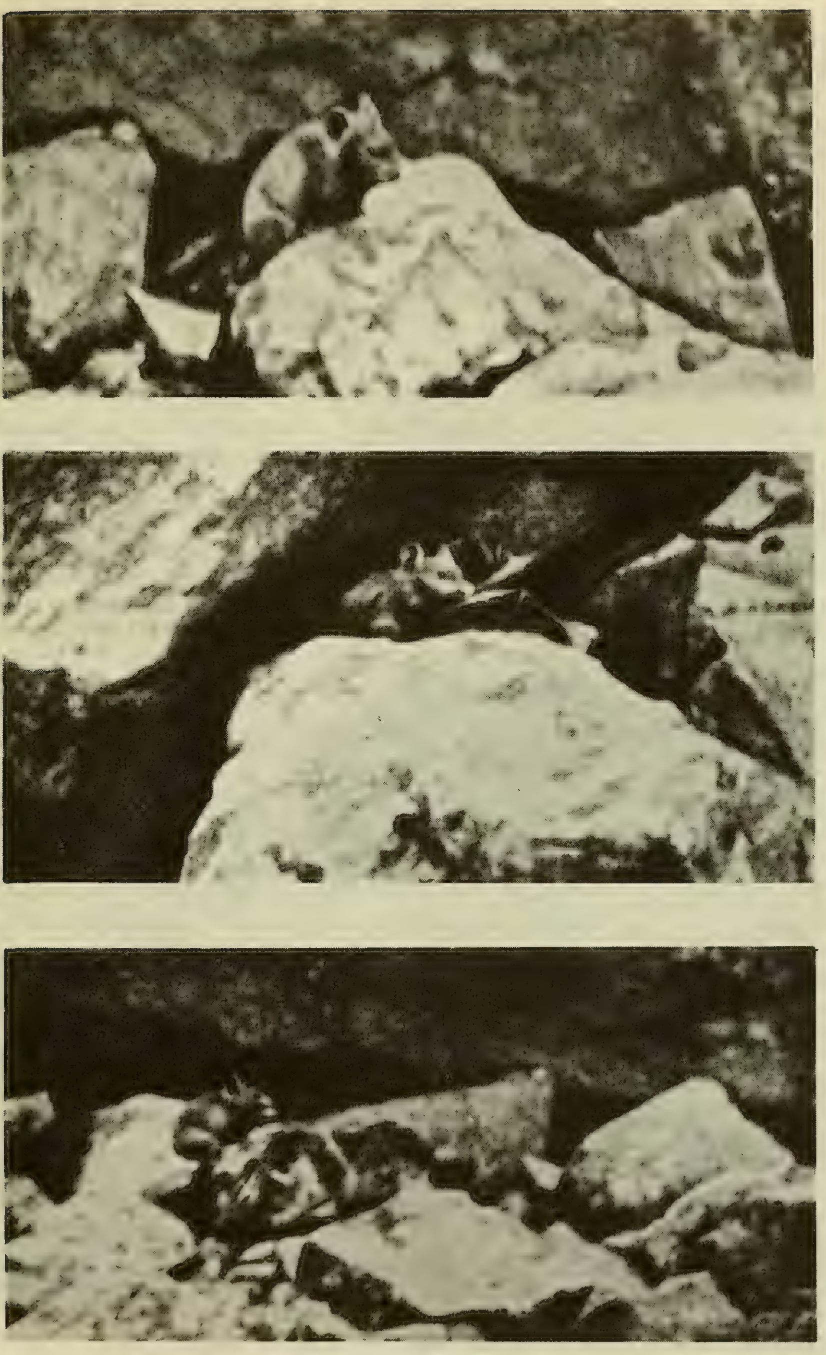
* Examination of new material collected in 1939 near the Bolshoe Almatinskoe Lake suggested that autumn molt begins at the lower part of the back and in small patches in the middle of the back.



Red pika (Ochotona rutila) carrying grass to its burrow. Trans-Ili Ala Tau, near the Talgar Mountain Pass, 29 July 1938

Photograph by S. I. Ognev

Species: O. thibetana Milne-Edw. (with subspecies); O. cansa Lyon (with subspecies); O. sorella Thos., O. syrinx Thos.; O. foresti Thos. apparently belong to this group.

DISTRIBUTION. From the left bank of the Volga through the steppe (non-desert) region of Transvolga and Transural to Omsk, Altai Region and Zaisan Basin trough. Some species are also known from Sikkim, Kansu, Shansi, Szechwan, Shensi, Yunnan.

The exact systematic relationship between these forms requires critical
98 examination of the material.

156. Ochotona pusilla Pallas (1768). Small pika or chekushka.

1768. (1769). Lepus pusillus Pallas P. S., Descriptio Leporis pusilli, Novi Commentarii Academiae Petropolitanae, t. XIII, pp. 531-538.

NAMES: Zwergpfeifhase (German).

LOCAL NAMES: zemlyanoi zaichik (ground rabbit); chivkun; "zhavoronok" ("sky lark"): or chekalka (Russian); chokchot, itchishkan (Tatar, imitating voice of animal); timersak, sepsan (Bashkir); kaik (Chuvash); kuzla (Kalmyk).

PRINCIPAL FIGURES: 1) Pallas P. S., Novi Comm. Academ. Petrop., 1768 (1769), tab. XIV, figs. 1-8 (entire animal, head, paws, intestine); 2) Pallas P. S., Novae species Quadrupedum e Glirium ordine, 1778, pp. 31-45, tab. I (drawing of entire animal); tab. IV, fig. 3 (ear), fig. 4 (skull frontal), fig. 5 (skeleton); 3) Schreber I. Ch., Die Säugethiere, Erlangen, B. IV, 1792, S. 906-910, tab. CXXXVII (color plate of entire animal); 4) Pallas P. S., Zoographia Rosso-Asiatica, 1811 (1831), pp. 151-152, tab. XII (color plate of entire animal); 5) Simashko, Yu., Russkaya fauna (Russian Fauna), II, 1851, pp. 790-791, pl. 63, fig. 1 (color plate of entire animal); 6) Argyropulo A. I., Opredelitel' gryzunov Ural'skoi oblasti (Key to Rodents of the Uralsk Region), Moskva, 1931, p. 8, fig. 33 (skull ventrally); p. 62, fig. 78 (skull laterally); 7) Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Materials on the Rodent Fauna of Soviet Central Asia), Trudy Zoologicheskogo instituta Akademii Nauk, I, 1932, p. 55, fig. 7 (skull of Ochotona pusilla pusilla Pall. dorsal, ventral and lateral); p. 56, fig. 8 (skull of O. p. angustifrons Argyrop. dorsal, ventral and lateral).

MATERIAL EXAMINED: 35 pelts with skulls.

DIAGNOSIS. Skull small, length in fully grown and old specimens not longer than 43 mm, usually 40 mm. Interorbital space of moderate breadth in comparison with size of skull, 3.6-5 mm. Interorbital space slightly arched. There are small facets on both sides of the interorbital space; and the middle part of the interorbital space seems therefore depressed.

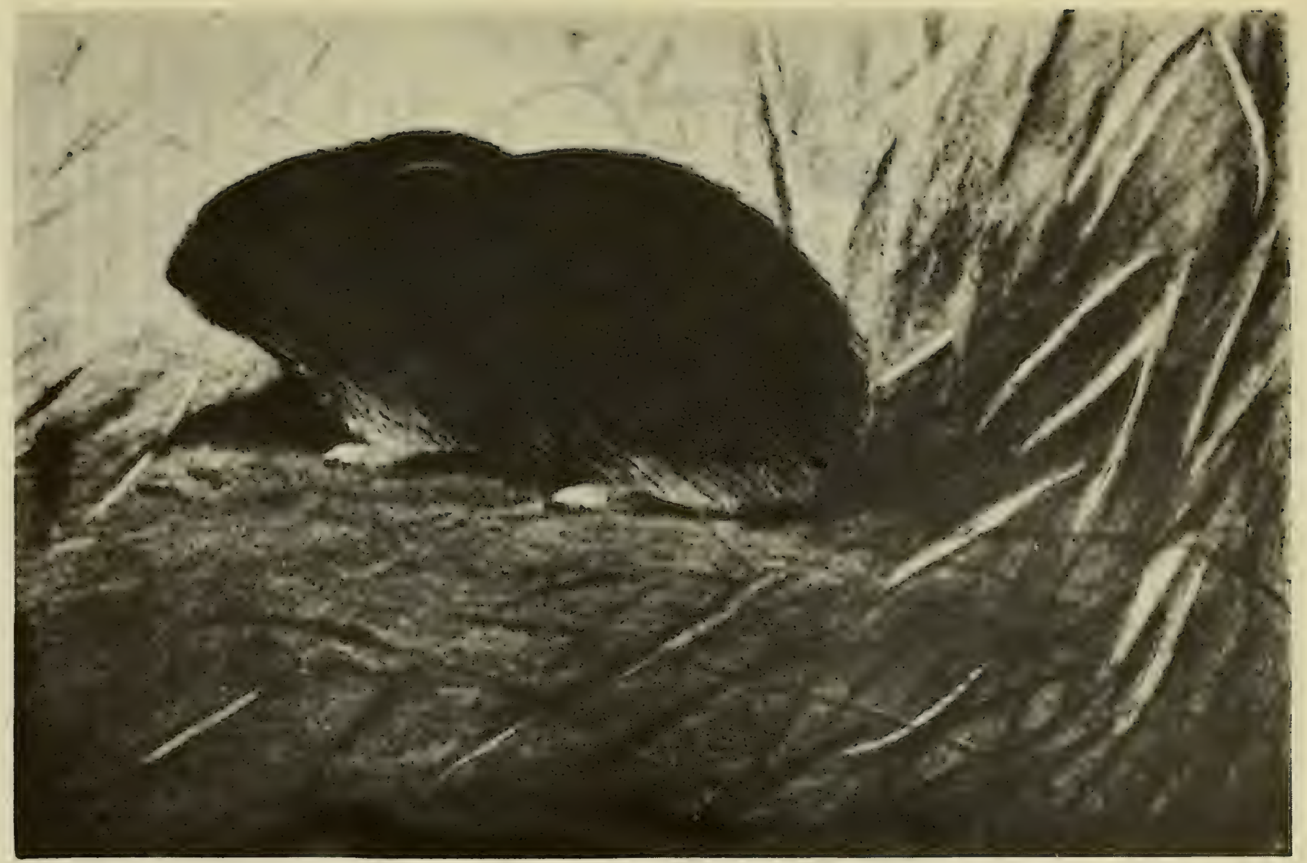
Nasals usually only slightly widened anteriorly; posterior parts of nasals broad. Frontals without fenestrae. Rostrum very short. Distance between inner margins of alveoli of last molars usually as long as the upper diastema measured to the alveoli of the second pair of incisors. Vomer not completely covered by premaxillaries. The vomer is therefore visible ventrally. Palatine and incisor foramina connected by a narrow space (Figures 51-54).

Vibrissae partly short and black-brown and partly white and longer, not longer than 45 mm. Soles brownish, with dense hair covering the pads of the digits unlike in all other species described. Ears with distinct light margins.

Color of summer fur dark grayish brown with more or less marked straw speckling on back and flanks; belly dull whitish gray. The winter fur slightly differs from the summer fur in its paler color.

Body length at most 200 mm, usually about 170 mm; hind feet at most 30 mm (usually about 27 mm).

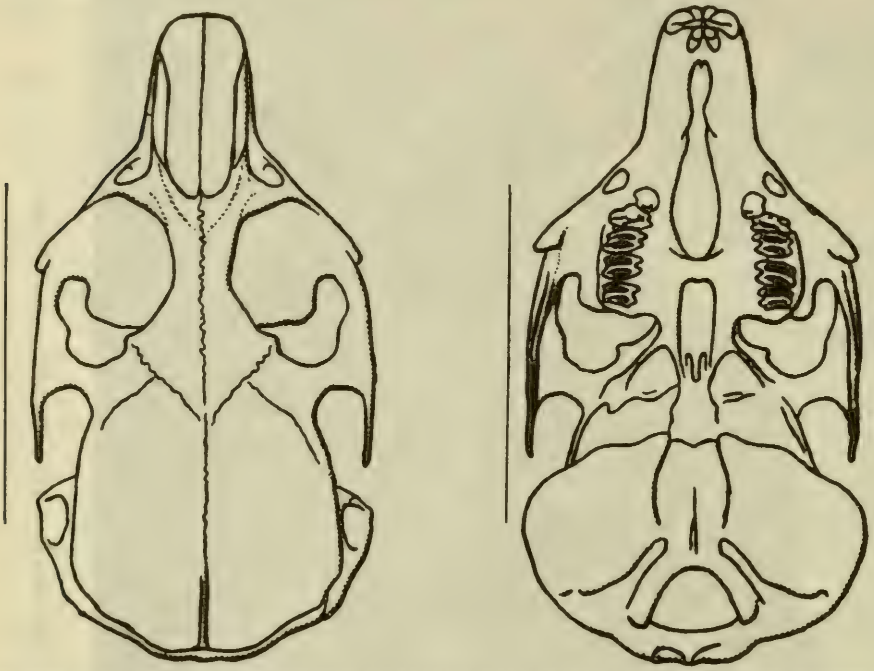
PLATE II



Small pika or chekushka (Ochotona pusilla Pall.)

Drawing by V. A. Vatagin

99 ADDITIONAL DESCRIPTION. In addition to the cranial characters described, the large size of the strongly swollen bullae osseae should be mentioned. They are slightly compressed laterally, and seem therefore larger than those of other species, for example O. hyperborea, the skull of which is of about the same size as that of O. pusilla. Orbits small and rounded. The brain case seems more elongate than in other species because of the short rostrum.



FIGURES 51, 52. Small pika, or chekushka, Ochotona pusilla angustifrons Argyrop. According to type no. 17421, river Dzhancha, former Kedei subdistrict, former Karkaralinsk County, Kazakhstan, Filatov, ZMAN collection

Drawing by Yu. A. Kostylev

SYSTEMATIC NOTES. The small pika differs sharply from the other species of Ochotona by the structure of the skull, color, the very hairy soles etc.

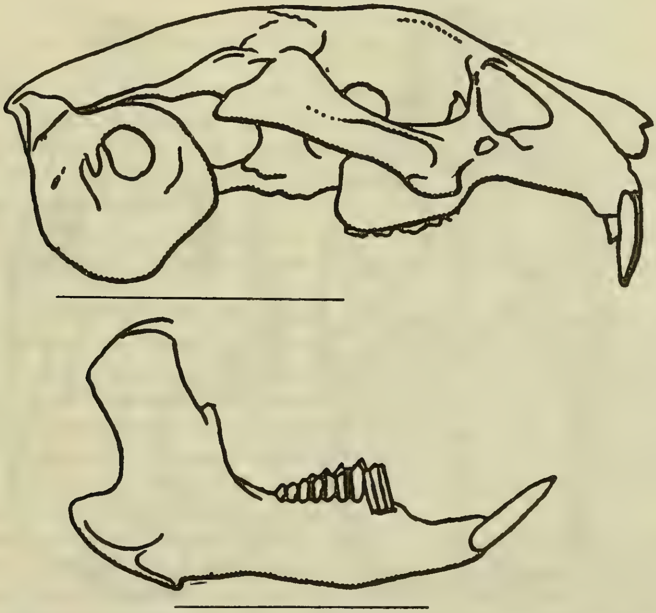
It would be justified to establish a separate subgenus for this species because of its separate position among our species. However, the small pika is closely related to the Tibet pika Ochotona thibetana Milne-Edw. (from Szechwan, Mupin). Ochotona thibetana has the following subspecies: O. t. sacraria Thos., southern Szechwan, O.t. sikimaria Thos., Sikkim, O.t. zappeyi Thos. (Tatsienlu [Kangting]). The following forms are closely related to thibetana, and therefore also to pusilla: Ochotona cansa Lyon (Kansu) with the subspecies O. cansa morosa Thos. (Shensi); O.c. stewensi Osgood (Szechwan); O. sorella Thos. (Shensi, Ningwufu); O. syrinx Thos. (southwestern Shensi); O. foresti Thos. (Yunnom, Liliang).

100 Most of these subspecies would have to be studied to give description of a proposed subgenus. However, I know only one form, O. thibetana Milne-Edw. well enough (Figures 55-58).

We therefore establish only the pusilla-thibetana group (vide supra) and postpone the creation of a subgenus until more material becomes available.

GEOGRAPHICAL DISTRIBUTION. The range of this species includes the Trans-Volga steppes to about 54° N (not including the Astrakhan Desert), the Obshchii Syrt, the Orenburg Territory in the north up to 53°30', and the Omsk, Semipalatinsk and Cisaltai regions. Its range reaches the Zaisan Depression and the southern slopes of the Tarbagatai in the southeast.

The first description of the range of this species was given by P.S. Pallas (Novae species Quadrupedum, 1778, pp.31-45). According to Pallas, Ochotona pusilla occurs in the southern foothills of the Urals, and is common between Kama and Samara. It is also found along the left bank of the Volga between Samara and Ural. It is very numerous between the Urals and Uem. It is absent in the forest zone and in the deserts in the lower reaches of the Volga and river Yaik (Ural). It occurs in the valley of the river Ilovlya* on the right bank of the Volga. Much new material has accumulated since the classical work of Pallas.



FIGURES 53, 54. Ochotona pusilla angustifrons Argyrop. After type No. 17421.

O. pusilla was recorded from the former Buguruslan and Buzuluk counties in the central Trans-Volga region. According to B.S. Bazhanov ("Materials on the Study of the Samara [Kuibyshev] Territory" (Materialy po izucheniyu Samarskogo Kraya), issue 5, 1928, pp. 19-20) it occurs 15 km north of the middle reaches of the river Buzuluk. It was also observed in the upper reaches of river Kamelik (a tributary of river Bolshoi Irgiz) north of Obshchii Syrt and along the river Irgiz (Eversman, 1850, 1855). A specimen from the vicinity of Spassk is in the ZMAN collection. (former collection of Professor Eversman). However, the occurrence of O. pusilla at such a northern locality (almost near 55°N) seems doubtful, as it was not found in the Tatar Republic in spite of intensive search by workers of the Volga-Kama Biological Station.

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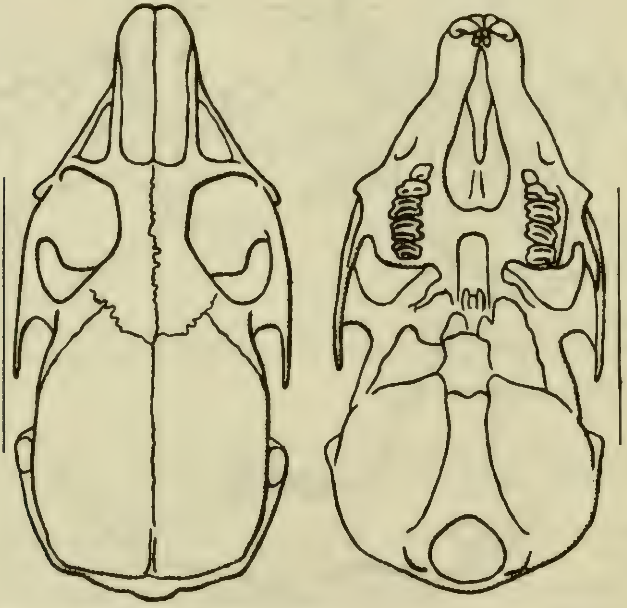
* This species does not occur today on the right bank of the Volga.

101 O. pusilla is common on the Obshchii Syrt. According to N.A. Zarudnyi (1897) it is common here in many places, and also in the upper reaches of the river Salmysh and the sources of river Chagan. He writes (1897) as follows: "East of the northern Obshchii Syrt, in Bashkiria, I found this species in very small numbers between the villages Isyangulova and Kugarchi." According to S.V. Kirikov, it is found in the upper reaches of river Belaya, near the Irgizly hamlet farm.

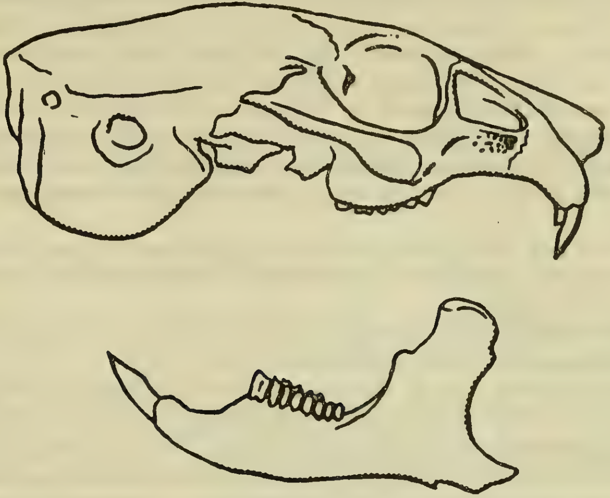
According to N.A. Zarudnyi (1897) it is common in the Orenburg District in places with high hillocks along the middle reaches of the Ural river, between Orsk and Uralsk. It was found in large numbers in the northern Mugodzhary Hills, in the Kyrchaki site, in the Donguz and Vetlyan Mountains, and on hillocks near Sulyuk-Kul. B.A. Kuznetsov (1928) recorded O. pusilla from near Uralsk and near the Saverov farm (former Orsk Country). In the ZMAN collection are specimens from the vicinity of Brody and the village Klyuchevka, from the former Kashira County, from the former Orenburg Province, from the vicinity of Orenburg and from river Or. According to A.I. Argyropulo



FIGURES 55, 56. Skull of Tibetan pika, Ochotona thibetana Milne-Edw., No. 157, May 1894, river Danho

Drawing by Yu. A. Kostylev

(1930), the most northern locality in the southern Urals where O. pusilla was caught is the Magnitnaya Railway Station (between 53 and 54°N).



FIGURES 57, 58. Lateral view of skull and mandibula of Ochotona thibetana Milne-Edw., No. 1577; see Figures 55, 56

N.P. Sabaneev (1872) wrote that O. pusilla occurred in the former Shadrinsk, Ekaterinburg and Chelyabinsk counties, at 55°30' N. He claimed
102 that the northern boundary of its range in the former Shadrinsk County reached 56°N in the east. In "Vertebrates of the Central Urals" (Pozvonochnye Srednego Urala), 1874, L.P. Sabaneev does not mention O. pusilla. He apparently found that his previous records were erroneous. It occurs farther east in the steppes to the south of Omsk according to Sotnikov.

B.A. Kuznetsov (1932) writes that it is widely distributed in the Semipalatinsk District and in the Altai. It was first observed between Semipalatinsk and Sergiopol [Ayaguz] along the Turkestan-Siberian Railroad. It was repeatedly found near Sergiopol [Ayaguz]. It is very common in the foothills of the western Tarbagatai, near Znamenka and the village Podgornyi. It was observed near Zmeinogorsk (c.f. Pallas, Meyer, Finch, A.M. Nikol'skii), and it was caught 90 km south of Zmeinogorsk (N.F. Kashchenko, 1900).

According to V.A. Selevin (in litt. 1935) it is found in the western Altai, the southern Kalbinskii Range, along the northern Turkestan-Siberian Railroad, in the Karaganda Region, along the hills south of the Spasskii Zavod to the border of the desert. A specimen caught by A.P. Razorenova in the Krasnoshchekovo District in the western Altai, near the village Kamenkovo (east of the river Belaya, a tributary of the Charysh) is in the Zoological Museum. It was recorded from the Zaisan depression by B.S. Vinogradov (1933).

It occurs in Kazakhstan in the eastern part of the Kazakh plateau in the grass-Artemisia steppe between Karkaralinsk and Kounrad, (A.M. Belyaev, 1934). Specimens caught along the river Dzhamcha and near the village Chelym in the former Karkaralinsk County are in the ZMAN collection.

If the distribution of this species in the past is compared with its recent distribution, it appears that its range is gradually receding.

Fossil remains of this species were found in the Pleistocene of Germany, Austria, France, Belgium, and England (F. Brandt, I. Woldrich, E. L. Trouessart, A. Nehring et al.) and in Quaternary deposits in the Crimea, in the former Kiev Province (I. G. Pidoplichka) and in old marmot burrows in the former Bobrov County in Voronezh Province (S. I. Obolenskii). All this clearly shows that the range of O. pusilla extended considerably further west in the past. Skeletal remains of O. pusilla found in Western Europe seem to be older than those found in the Ukraine and in the Voronezh Region.

O. pusilla still occurred on the right bank of the Volga, in the valley of river Ilovlya, a tributary of the Don, in Pallas' time (Novae species Glirium, 1778, p. 31.).

Various data indicate that this species becomes constantly rarer in the Trans-Volga and in western Siberia.

MODE OF LIFE. B. A. Kuznetsov (1928) gives the following data on the habitats of O. pusilla in the Orsk Region: "It is very difficult to determine the favorite habitat of the pika. One can hear the loud cry of this animal everywhere in the evening, from a haystack, from wheat fields, or from a ravine at dusk. I heard their cry repeatedly in the middle of a farm, where they live in weeds near fences.

103 "The pika is heard everywhere, but it is very difficult to see because of its secretive habits. It lives in dense thickets, in wheat fields, wild cherry brush or among weeds along fences in a village."

Further observations on the habitats of the small pika in the Semipalatinsk District are found in "Rodents of the Semipalatinsk District" by B. A. Kuznetsov (Gryzuny Semipalatinskogo okruga. — Byulleten' Moskovskogo Obshchestva Ispytatelei Prirody, XVI (1-2):114, 1932).

"The pika lives most frequently in thickets of peashrub, wild rose, Filipendula and others in the valleys. It is most numerous in the mixed grass belt. It is very rare on the border of the Balkhash Steppes. Pikas are also rare on the summits of hills. O. pusilla is very common near the village Podgornyi, among shrubs in valleys. They are rarer among the weeds in farms or in crevices among rocks.

"I came across O. pusilla repeatedly on the summits of hills in the Glavnyi Range at an altitude of 1500 near Podgornyi. I was surprised to hear the voice of this typical steppe animal in meadows in high mountains. It was once heard in the Saur Mountains (the Zaisan forestry, near the village Chegan-Obo) on the southern slope of a valley high in the mountains. I did not find it in other parts of the Semipalatinsk District."

As mentioned above, O. pusilla leads a very secretive life, but it can be easily spotted by its characteristic cry consisting of a rapidly repeated "chiv-chiv-chiv". It cries loudest and most frequently at sunset. It can be heard, however, also on cloudy days, and especially in the morning. It apparently does not leave its burrow at night. The burrows are shallow and have several exits. B. A. Kuznetsov did not find "haystacks" of this species near Orsk or in the Semipalatinsk District.

Our knowledge of the reproduction of O. pusilla is very fragmentary. P. Pallas once obtained a gravid female (30 Apr.). She gave birth to 6 young which remained blind for 7 days. They opened their eyes on the 8th day, their fur began to grow and they began to crawl around the burrow.

Three females out of 5 caught by B. A. Kuznetsov in the Orsk District were gravid. The others were already suckling their young. The number of embryos and their size in several specimens were as follows:

No. 111 — 6 embryos of 15 mm length
No. 144 — 11 " " 35 " "
No. 145 — 12 " " 10 " "

These females were caught in late summer: No. 111 on 25 July; No. 144 and 145 on 29 July. We can therefore state definitely that O. pusilla has at least two generations in summer and autumn.

104 *Subspecies of Ochotona pusilla*

325. Ochotona pusilla pusilla Pallas (1768). European chekushka

1768 (1769). Lepus pusillus. Pallas P., Descriptio Leporis pusilli. Novi Commentarii Academiae Petropolitanae, t. XIII, pp. 531-538.

1778. Lepus pusillus. Pallas P., Novae species Quadrupedum e Glirium ordine, pp. 31-45.

1811. Lepus pusillus. Pallas P., Zoographia Rosso-Asiatica, pp. 151-152.

1850. Lagomys pusillus Eversman E., Estestvennaya istoriya mlekopitayushchikh Orenburgskogo kraya (Natural History of Mammals of the Orenburg Territory), pp. 207-208.

1851. Lagomys pusillus Simashko Yu., Russkaya Fauna. Mlekopitayushchie (Russian Fauna. Mammals), Vol. II, pp. 790-791.

1891. Lagomus pusillus Nehring A., Die geographische Verbreitung der Säugethiere in dem Tschernosem-Gebiete. — Ztschr. der Gesellsch für Erdkunde, XXVI, No. 4, S 323-326.

1897. Lagomys pusillus Zarudnyi N. A., Zametki po faune mlekopitayushchikh Orenburgskogo kraya (Notes on the Mammal Fauna of the Orenburg Territory). — Materialy k poznaniyu fauny i flory Rossiiskoi Imperii, III, p. 360.

1928. Ochotona pusilla Kuznetsov B. A., Zamtki po faune mlekopitayushchikh Ural'skoi gubernii (Notes on the Mammal Fauna of the Uralsk Province). — Trudy po lesnomu opytnomu delu, No. 1, p. 58; Auct. cit., Mlekopitayushchie stepnoi polosy Yuzhnogo Urala (Mammals of the Steppes of the Southern Urals). — Byulleten' Moskovskogo obshchestva ispytatelei prirody, Vol. XXXVII, No. 3-4, otdel Biologiya, pp. 259-262. 1928.

1932. Ochotona pusilla pusilla Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Data on the Rodent Fauna of Soviet Central Asia). — Trudy Zoologicheskogo Instituta Akademii Nauk, I. pp. 52-55.

TYPE LOCALITY AND DEPOSITION: Pallas (1768) mentions in his first description the Volga steppes (in campis circa Volgam...). The Samara steppes should be considered as terra typica (e. g. the Buzuluk District). It is not known whether the holotype has been preserved. It is not in the ZMAN collection.

MATERIAL EXAMINED: 12 pelts with skulls.

DIAGNOSIS. Brown color very prominent on back in summer fur; deep brown or black hair tips well marked.

Length of skull less than 40 mm. Skull of old specimens little elevated in the nasofrontal region.

Length of skull 35-38.7 mm (M. 36.9); condylobasal length 32.0-36.7 mm (M. 34.4); zygomatic width 18.4-19 mm (M. 18.7); width of skull at level of auditory meatus 18.1-19.8 mm (M. 18.9); length of upper tooth row 6.9-7.3 mm (M. 7.1). Body length 153-182 mm (M. 167.2); hind feet 26-27.5 mm (M. 26.7).

ADDITIONAL DESCRIPTION. General color of summer fur on back deep chestnut-brown with a slight straw tinge. Color of top of head and lower part of back intensively brown because of the well marked black-brown hair tips. Straw color most marked on flanks. Underparts dirty-gray with a whitish tinge; neck and belly (especially the lower part) with a light rust-yellow shade. Inner side of ears with deep brown hair; lower part of ears with short gray hair. The hair is more intensely brown

105 towards the ear margins which are whitish. Legs dark brown; hair on tips of digits lighter, whitish gray. Claws horn yellow, covered by the long hair of the digits.

GEOGRAPHICAL DISTRIBUTION. From the right bank of the middle reaches of the Volga (54°N) to the southern foothills of the Urals (to 53°30' N), reaching the basin of the river Or' in the southeast.

326. **Ochotona pusilla angustifrons** Argyropulo (1932)
Siberian chekushka

1884. Lagomys minutus Nikol'skii A. M., Puteshestvie v Altaiskie gory (Journey to the Altai Mountains). — Trudy Sankt-Peterburgskogo obshchestva estestvoispytatelei, XI, p. 177.

1900. Ochotona pusillus Kashchenko N. F., Opredelitel' mlekopitayushchikh Tomskogo kraya (Key to Mammals of the Tomsk Territory), pl. 30.

1932. Ochotona pusilla Kuznetsov B. A., Gryzuny Semipalatinskogo okruga (Rodents of the Semipalatinsk District). — Byulleten' Moskovskogo obshchestva ispytatelei prirody, XII (1-2): 114-115.

1932. Ochotona pusilla angustifrons Argyropulo A. I., Materialy po faune gryzunov Srednei Azii (Data on the Rodent Fauna of Soviet Central Asia). — Trudy Zoologicheskogc instituta Akademii Nauk, I, pp. 55-57.

TYPE LOCALITY AND DEPOSITION: Along river Dzhamcha, former Kedei subdistrict, former Karkaralinsk County, Kazakhstan. Type No. 17421 in ZMAN collection (pelt and skull).

MATERIAL EXAMINED: 23 pelts with skulls.

DIAGNOSIS. Differs from subspecies in its lighter color with more prominent straw-grayish tones which create a distinct mottling caused by the black-brown hair tips of the back.

Skull of old specimens more elevated in nasofrontal region than in nominate (Figures 51-54, 59-61).

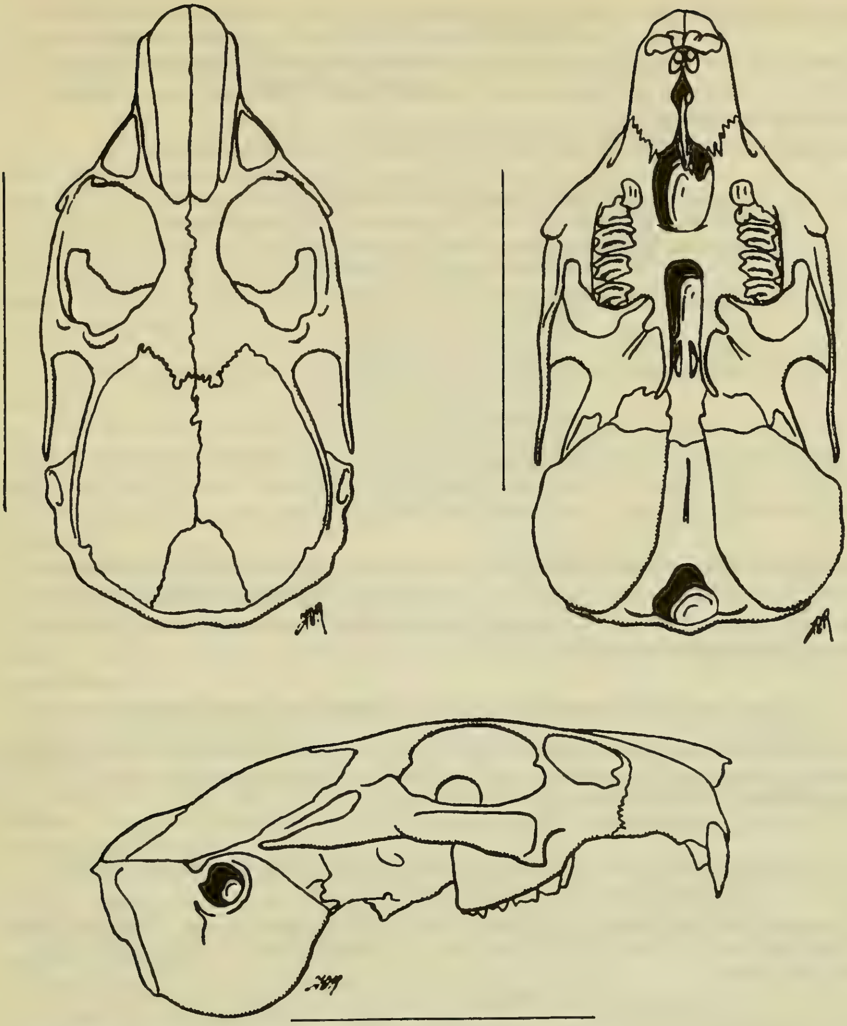
Length of skull 39.7-43.2 mm (M. 40.9); condylobasal length 37.2-40.2 mm (M. 38.2); zygomatic width 18.9-22.3 mm (M. 20.3); width of skull at level of auditory meatus 20-22.2 mm (M. 20.8); length of upper tooth row 7.8-8.8 mm (M. 8.3).

Body length 182-196 mm; hind feet 26-30 mm (M. 28 mm).

SYSTEMATIC NOTES. The eastern subspecies of O. pusilla differs markedly from the nominate race. The differences in color are very distinct when series are compared.

A.I. Argyropulo had only 3 specimens of the Siberian subspecies. He selected an old specimen as type, the skull of which is larger than all the skulls of the large series collected by B. A. Kuznetsov in the Semipalatinsk District. Some cranial characters given by A.I. Argyropulo for O. p. angustifrons, such as the narrow interorbital space, its elevation in profile, the large size of the bullae osseae, the slightly longer rostrum etc. are found only in the very old skull mentioned above. This skull has several individual characters which distinguish it from the other specimens of the series.

GEOGRAPHICAL DISTRIBUTION. Omsk, Altai, Semipalatinsk and Zaisan-Tarbagatai districts.



FIGURES 59-61. Skull of Ochotona pusilla angustifrons Argyrop., No. 2350, 8 June 1929. Semipalatinsk District of Sergiopol [Ayaguz] Region, Znamenka Village, B. A. Kuznetsov
Drawing by Yu. A. Kostylev

Family LEPORIDAE, HARES

1821. **Leporidae** Gray J., London Med. Repos., XV, p. 304.
1857. **Leporina** Blasius J., Naturgesch. der Säugethiere Deutschlands, S. 409.
1897. **Lagidae** Schultze E., Helias, XIII, S. 82; Catalogus Mammalium europaeorum, Ztschr. für Naturwissensch., Bd. 73, 1900, S. 209.

Rodents of the suborder Duplicidentata, mainly characterized by the
107 long ears and elongate hind legs. Tail short and well developed. Nasals not widened anteriorly; postorbital processes well developed; lateral surface of maxillaries spongiose; skull relatively high, not much flattened. Bullae osseae rounded, of moderate size; with solid, bony, not spongiose wall. Clavicles small or rudimentary. Pubic symphysis well developed.

Dental formula: $i\frac{2}{1}$; $c\frac{0}{0}$; $p\frac{3}{2}$; $m\frac{3}{3}$ = (23)*.

We consider the family Leporidae as consisting of 11 genera and 8 subgenera. A revision of these genera and subgenera may make a new classification possible.

At present we recognize the following genera and subgenera:

I Genus Lepus with the subgenera:
1) Lepus s. str., 2) Eulagus, 3) Poecilolagus, 4) Boreolagus,**
5) Microlagus, 6) Macrotolagus
II Genus Sylvilagus with subgenera
7) Sylvilagus s. str., 8) Tapeti
III Genus Brachylagus
IV Genus Romerolagus
V Genus Oryctolagus
VI Genus Limnolagus
VII Genus Pronolagus
VIII Genus Nesolagus
IX Genus Caprolagus
X Genus Allolagus
XI Genus Pentalagus

GEOGRAPHICAL DISTRIBUTION. Eurasia, from the Boreal-Arctic zone to the Tropics, North America (to Central Mexico), Japan, Ryukyu Islands, Sumatra, Africa. Oryctolagus was introduced into Australia, where it has multiplied enormously.

KEY TO GENERA AND SUBGENERA OF HARES (LEPORIDAE) OF THE U. S. S. R.

1 (2). Ear (measured from occiput) shorter than head. Interparietal well developed both in young, adult and old specimens. Postorbital processes narrow, thin, swordlike, not elongate triangular. Fossa mesopterygoidea markedly narrower than length of bony palate.

Genus Oryctolagus Lilljeb.

2 (1). Ear as long as head or longer. Interparietal absent in adults. Postorbital processes elongate triangular. Genera Lepus L. and Allolagus Ogn.

3 (4). Ear usually as long as head, rarely a little longer. Hind legs relatively short. When the animal stands, the hind legs appear only little higher than the forelegs. Mesopterygoid fossa about as wide as the length of the bony palate.

Genus Allolagus Ognev.

4 (3). Ear always longer than head, sometimes 1 1/2 times as long. Hind legs relatively long; when the animal stands, they appear much higher than the forelegs.
108 Mesopterygoid fossa 1 1/6 to 3 times as wide as the length of the bony palate.

Genus Lepus L.

5 (6). Head relatively large. Ears short, 1/10 - 1/8 longer than head. Tail including terminal hair much shorter than hind foot. Tail in summer fur whitish gray, gray dorsally; tail in winter fur white. Winter fur of most forms snow white, as opposed to summer fur. Anterior lower premolar slightly inclined backwards.

Subgenus Lepus L. s. str.

6 (5). Head relatively small. Ears markedly longer than head, 1 1/5 - 2 3/4 times longer. Tail including terminal hair about as long as hind foot without claws, 80-95 % of length of foot. Tail of summer and winter fur white with sharply contrasting, black (rarely brown) dorsal side.

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* $m\frac{2}{3}$ (as in Ochotonidae) only in Pentalagus Lyon.

** M. Degerbøl and F. Wimpffen Braestrup (1934) consider the creation of this subgenus as not justified (see below).

Winter fur never completely white, brown tones always persisting on back. Only slight differences between summer and winter fur in western, southern and desert forms.

Anterior lower premolar sharply inclined backwards.

Subgenus Eulagos Gray.

Genus Lepus Linnaeus (1758)

1758. Lepus Linnaeus Carolus, Systema Naturae, Ed. X, p. 57.

1829. Chionobates Kaup Jakob, Skizzierte Entwicklungs-Gesch. d. Europ. Thierwelt, I, S. 170 (based on Lepus variabilis and L. borealis).

1867. Eulagos Gray J. E., Annals and Magaz. of Natur. History, Sept. p. 222 (based on Lepus mediterraneus Wagner, and L. judeae Gray).

1899. Eulepus Acloque Alex., Faune de France, Mammifères, p. 52 (based on L. europaeus and L. variabilis).

Ear measured from occiput longer than head, sometimes 1 1/2 times as long.

Tail dorsally black or brown, markedly different from the white ventral side (subgenus Eulagus), or tail in summer whitish gray with well marked gray color dorsally; tail in winter white (subgenus Lepus).

Hind legs long, appearing much higher than forelegs when the animal stands.

Mesopterygoid fossa (1 1/6 to 2 times as wide as length of bony palate.

Interparietal of adults reduced.

Postorbital processes elongate triangular. Nasals in their posterior third 1 1/5 - 1 1/3 as wide as the interorbital space behind the postorbital processes.

Nasal measured along their oblique outer side shorter, as long as, or longer than, frontal suture measured to its anterior point between the nasals.

109 Width of posterior nasal opening 1 1/5 - 1 1/3 as wide as length of bony palate, width of anterior nasal opening twice, sometimes 3 times, the length of the bony palate.

Width of incisive foramina posteriorly 1 1/8 - 1 1/4 (Lepus) or 1 1/3-1 1/2, sometimes twice (Eulagus) the length of bony palate.

Incisive foramina sometimes little, sometimes markedly shorter than upper diastema.

Genotype: Lepus timidus Linnaeus.

GEOGRAPHICAL DISTRIBUTION. Eurasia, North America to about 25°N in the south), Africa (in the southern part).

Subgenus Eulagus* Gray J. E. (1867) Desert and Tolai hare

Eulagos Gray J. E., Annals and Magaz. of Natur. History, Sept. p. 222.

Head relatively small. Ear large, 1 1/5 - 2 3/4 as long as head.

Tail including terminal hair about as long as hind foot without claws. Tail 80-95% of length of foot.

Tail in summer and winter fur white with well-marked, contrasting black (rarely brown) dorsal side**.

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* We use the spelling Eulagus (instead of Eulagos) for consistency.

** Tail completely white in Lepus oiostolus Hodgson (I have not seen the type specimen), (W. T. Blanford, The Fauna of Brit. India, 1887? p. 453). Tail dorsally rust-red in the Indian species Lepus ruficaudatus Geoffr. I have not seen the Indian species and I cannot therefore decide whether it belongs to the group of common hares.

Teats 6 (in true common hare and Tolai hare) or 8 (in desert hare).

Winter fur never completely white, brown shades always persisting on back. Winter fur very slightly different from summer fur in southern and desert forms.

Nasals as long as, or markedly longer than, frontal suture.

Incisive foramina 1 1/3 to twice as wide as length of bony palate.

Anterior lower premolar sharply inclined backwards.

Type of subgenus: *Lepus mediterraneus* Wagner, and also *L. judeae* Gray.

GEOGRAPHICAL DISTRIBUTION. Europe and Asia, in temperate and southern zones. South African hares belong to a separate subgenus, *Pronolagus* Lyon; North African hares belong to the genus *Oryctolagus**. Hares of Mesopotamia, Palestine and Arabia belong to the subgenus *Eulagus*. Hares of the subgenus *Eulagus* are absent in

110

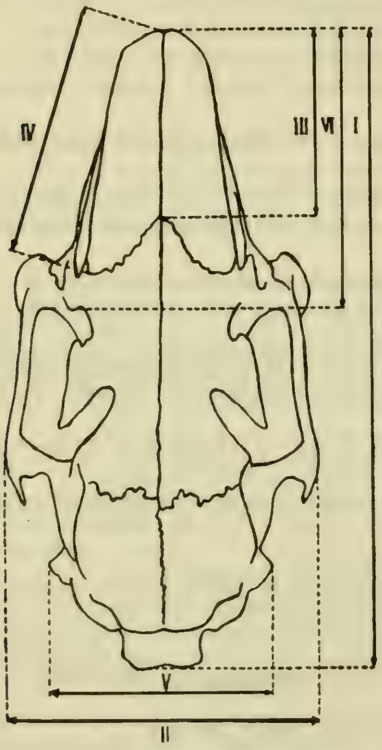

FIGURE 62. Measurements of skull of hare

I — total length of skull; II — zygomatic width; III — length of nasals (along suture); IV — length of nasals (along outer side); V — width at level of auditory meatus; VI — lateral length of facial part of skull (anteriorly to alveolar point, but not to the end of nasals).

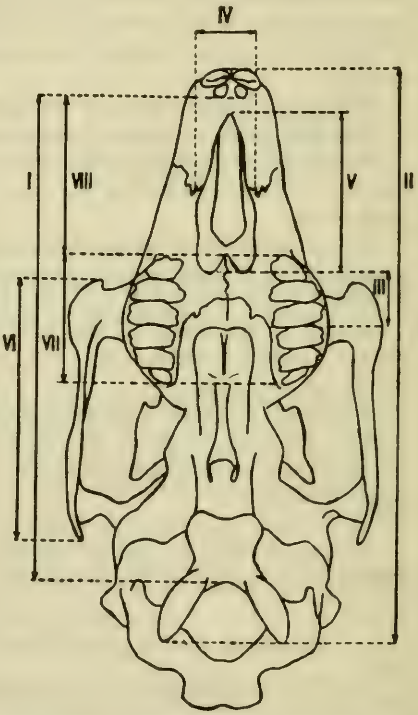

FIGURE 63. Measurements of skull of hare

I — basal length; II — condylobasal length; III — length of bony palate; IV — width of incisive foramina; V — length of incisive foramina; VI — length of pygomatic arch: VII — upper diastema.

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* [Species of *Lepus* also occur in North Africa.]

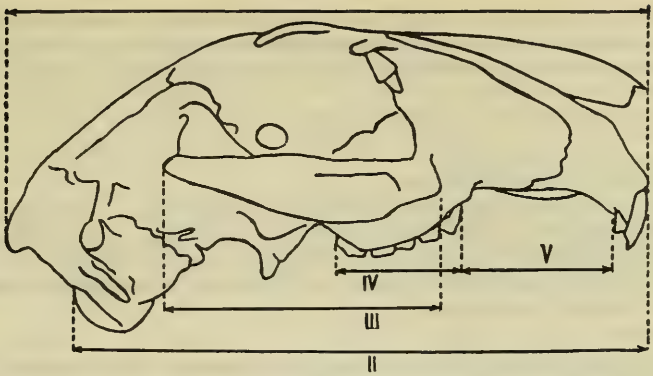

FIGURE 64. Measurements of skull of hare

I — length of skull; II — condylobasal length; III — length of zygomatic arch; IV — length of row of upper molars; V — upper diastema.

Japan and in North America. The subgenus Macrotolagus Mearns in North America is closely related to the subgenus Eulagus. Macrotolagus is distributed in Mexico and in southwestern parts of the United States of America.

111

KEY TO SPECIES OF THE SUBGENUS EULAGUS OF THE U.S.S.R.

1 (2). Large, length of body usually more than 570 mm; length of hind foot 135 mm; length of skull usually more than 90 mm (100 mm and more).

Fur coarse, guard hair dense, curled on back in several subspecies. Ratio of length of bony palate to greatest width of mesopterygoid fossa 55.8 % on the average.

Lepus (Eulagus) europaeus Pall.

2 (1). Much smaller, length of body usually less than 570 mm; hind foot less than 135 mm long, length of skull usually less than 90 mm.

Fur smooth, silky; guard hair smooth, delicate, straight. Ratio of length of bony palate to greatest width of mesopterygoid fossa 70.5 % on the average (Tolai hare) and 75 % (desert hare).

3 (4). Ear (measured from occiput) 1 1/5 to 1 1/3 longer than skull, i. e., ear relatively short. Teats 6.
Width of both nasals posteriorly usually considerably exceeding length of postorbital process.
Mandibular condyle strongly developed, moderately inclined backwards.

L. (E.) tolai Pall.

4 (3). Ear measured from occiput 1 1/4 to 1 3/4 longer than skull. Teats 8.
Width of both nasals (posteriorly) usually equal to length of postorbital process*.
Mandibular condyle weak, strongly inclined backwards.

L. (E.) tibetanus Waterh.

KEY TO SUBSPECIES OF LEPUS (EULAGUS) EUROPAEUS PALL. IN THE U.S.S.R.

1 (4). Fur on back wavy, clay-rust-yellow, without dull earth-gray and black shades.

2 (3). Length of skull usually exceeding 100 mm; length of hind foot without claws exceeding 150 mm, usually about 160-170 mm. Color of summer fur on back light clay-rust-yellow. Winter fur with marked gray and white tones.

Lepus (Eulagus) europaeus hybridus Desm.

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* This character is not always true; there are exceptions.

3 (2). Length of skull usually less than 100 mm; length of hind foot less than 150 mm, usually about 140 mm. Clay tones of summer fur on back more intense and darker than in L. europaeus hybridus. Winter fur almost the same as summer fur in color, in length and in density of hair; only lower part of back is slightly grayer.

L. europaeus europaeus Pall.

4 (1). Fur on back not wavy, i. e. hair straight.

5 (6). Fur on back very light in summer, rust-clay colored with a sandy tinge. Color of winter fur duller, sometimes more intense than summer fur with a less well marked rust tinge. Fur of specimens from 112 southern parts of the range of the Caspian common hare is less gray; the gray color is marked only on the lower part of the back. White fur is observed only in specimens from the extreme northeastern range.

L. e. caspicus Ehrenb.

6 (5). Summer fur on back either dull brownish yellow gray with an earthy tinge, often with marked black tone, or more yellowish clay with an earthy tinge. Grayness of winter fur varying in degree.

7 (8). Winter fur markedly more white and gray than summer fur. Size large: hind foot 167-185 mm long; length of skull of fully grown specimens usually exceeding 100 mm. Weight 6-6.4 kg.

L. e. tesquorum Ogn.

8 (7). Winter fur not becoming white, only grayish in posterior part of back. Size and weight much smaller than in L. e. tesquorum Ogn.

9 (12). Reddish clay tones on chest and flanks marked to various extent. Winter fur without vinaceous tinge*.

10 (11). Reddish clay tones on chest and flanks well marked. Length of hind foot 123-160 mm; length of skull about 100 mm, sometimes less, 89.3, or sometimes more than 101 mm. Weight about 3.2 kg (2.9-3.9 kg).

L. e. transsylvanicus Matschie.

11 (10). Reddish clay tones on chest and flanks weakly marked, replaced by clay-yellow-gray tones. Length of skull about 100 mm (92-105 mm); length of hind foot 140-167 mm. Weight about 4 kg (3.2-4.4 kg).

L. e. caucasicus Ogn.

12 (9). Reddish clay tones on chest and flanks absent and replaced by dull straw-brown (in summer) or dull straw-gray (in winter). Winter fur with characteristic vinaceous tinge.

Length of hind foot 144-150 mm; length of skull usually less than 100 mm (91-103 mm).

L. e. cyrensis Satun.

157. Lepus (Eulagus) europaeus Pall. (1778)

1778. Lepus (europaeus) Pallas P., Novae Species e Glirium ordine, p. 30 (short diagnosis: "Apice aurium capite longiorum, caudaque supra atra", without indication of range)

1811. Lepus timidus Pallas P., Zoographia Rosso-Asiatica, p. 148 (Polonia, Lithuania).

NAMES: Common or brown hare (English); Lampe, Feldhase (German); Le lièvre commun (French).

LOCAL NAMES: rusak, seryak (latter apparently designating steppe rusak, Russian); tumak (hybrid between common hare and white hare); according to others, e. g., M. N. Bogdanov, tumak = steppe rusak; zaets sirii, or zvychainyi (Ukrainian); Kuyan (Bashkir); köch' (Komi-Zyryan); toshan (Armenian); urcheli (Georgian); tkhakumakikh (Kabardian); kuyan (Balkar); tulai (Kalmyk).

PRINCIPAL FIGURES: 1) Schreber I., Säugethiere, Erlangen, IV, 1792, Taf. CCXXXIII (Lepus timidus = europaeus); Taf. CCXXXVC. (Lepus variabilis Pall. hybridus - tumak); 2) Bingley W., Memoirs of British Quadrupeds, 1809, p. 290 (color pl.); 3) Simashko, Yu., Russkaya fauna. Mlekopitayushchie (Russian Fauna. Mammals), II, 1851, pp. 782-785, pl. 62, fig. 2 (color pl. of winter fur, named Lepus aquilonius); pl. 60, fig. 1; pl. 61, fig. 4 (color pl. and drawing of skull, named Lepus europaeus); 4) Middendorf A. Th., Ueber die als Bastarde angesprochenen Mittelformen zw.

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* Vinaceous buff-avellaneous (Ridgway, 1912).

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H., Lydekker R., An Introduct. to the Study of Mammals, 1891, p. 492, fig. 216 (skull); fig. 217 (entire animal); 12) Lydekker R., A Hand-Book to the British Mammalia, London 1895, pl. XXVII (entire animal, color plate); 13) Brehm A. E., Zhizn' zhivotnykh (Animal Life), II, 1893, p. 656 (half tone plate of entire animal); 14) Menzbier M. A., Iz zhizni zverei i ptits (On Life of Animals and Birds), 1887, p. 120 (plate, biological scene); 15) Forsyth Major, C. I. On fossil and recent Lagomorpha, Transactions of the Linnean Society of London, Vol. VII, Zoology, 1896-1900, pl. 36, fig. 25 (teeth); 16) Gaake, V., Zhivotnyi mir (Animal World), Vol. I, 1901, plate 19 (in color); 17) Lyon M. W., Classification of the hares and their allies, Smithson. Miscellaneous Collections, Vol. I, prt. 3-4, 1903 (1904), pl. LXXIV, fig. 2-2a (skull ventral and dorsal); pl. LXXV, fig. 3 (skull lateral); pl. LXXX and LXXXI, fig. 2 (skull dorsal and ventral); 18) Millais I. 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R.), Moskva, 1935, p. 50, fig. 39 (tail); fig. 40 (figure on right side - entire animal); 38) Manteifel' P. A., Zaitsy SSSR (Hares of the U. S. S. R.), in Sbornik "Biologiya zaitsev i belok", Moskva, 1935, p. 18, fig. 2 (copulation); 39) Gureev A. A., Kraniologicheskie priznaki zaitsev belyaka i rusaka (Cranial Characters of Blue and Common Hare), Trudy Zoologicheskogo Instituta Akademii Nauk, III, 1936, pp. 356, 357, 362, figs. 2, 4, 6, 8 (skull and details).

114 MATERIAL EXAMINED: 249 pelts and 291 skulls.

114 DIAGNOSIS. Head relatively small. Ear measured from occiput 1 1/5 to 1 1/2 times longer than skull.

Tail including terminal hair about as long as hind foot without claws.

Tail in summer and winter fur white with dorsal side black, sharply contrasting.

Winter fur never completely white; brown tones always persisting on back. Winter fur differs slightly from summer fur in southern and desert forms.

Hair coarse; guard hair dense, curled on back in several subspecies.

Teats: p: 1-1; a: 2-2; total: 6.

Posterior third of incisive foramina markedly widened and slightly curved.

Ratio of length of bony palate (measured laterally, from the medium anterior process) to greatest width of incisive foramina (in their posterior third) 56%.

Mandibular condyle weak, strongly inclined backwards.

Posterior ventral plate of mandible from angular process to notch at the anterior horizontal mandibular process rather weakly developed. Distance from angular process to notch at anterior horizontal mandibular process about equal to, sometimes smaller than, distance between anterior alveolus of first molar and tip of lower incisor.

Bullae osseae small and inflated; slightly protruding in profile and rounded anteriorly.

Length of ear along concavity 100-120 mm; length of ear (measured from occiput) 120-171 mm; length of hind foot 124-167 mm.

ADDITIONAL DESCRIPTION. Skull relatively elongate, rostrum long and slender. The specific characters of the skull of the common hare are very distinct when compared with the skull of the blue hare.

This has been carefully studied by various authors*.

115 Compared with the skull of L. timidus, the skull of the common hare is very elongate, narrow, and the nasals are long. Interorbital space of the common hare generally narrower than that of L. timidus. Zygomatic arch narrow; in lateral view does not rise so steeply posteriorly and does not delimit the lower side of the orbit as in L. timidus. Orbit of L. timidus markedly different from that of common hare. Incisive foramina of common hare generally longer than those of L. timidus.

Yu. A. Filipchenko (1916) gives the following variations of this character: in L. timidus 22-27.5 mm (M. 24.30 mm); in the common hare 24-29 mm (M. 26.19 mm).

116 The best distinguishing character is the ratio of the length of the bony palate to the width of the incisive foramina and the mesopterygoid fossa (see above).

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* A. Th. Middendorf, Ueber die als Bastarde angesproch. Mittelformen z. L. europaeus und L. variabilis, Bull. phys.-mathem., IX, No. 14, 1851; I. Blasius, Naturgesch. d. Säugethiere Deutschlands, 1857, S. 412-414, 420-421; C.G. Giebel, Charakteristik der Hasenschädel, Ztschr. für die ges. Naturw., Bd. LIII, 1880, S. 318-340; M. Hilzheimer, Die Hasenarten Europas, Jahresb. d. Vereins f. vaterl. Naturkunde in Württ., 1908. S. 384-419; G.S. Miller, Catalogue of the Mammals of Western Europe, London, 1912, pp. 498-502, 522-526; S.I. Ognev, Mlekopitayushchie Moskovskoi gubernii (Mammals of the Moscow Province), Moskva, 1913, pp. 283-286; Yu. A. Filipchenko, Izmenchivost' i nasledstvennost' cherepa u mlekopitayushchikh (Variability and Heredity in the Mammalian Skull), Russkii arkhiv anatomii, gistologii i embriologii, 1 (2): 329-344. 1916.

115

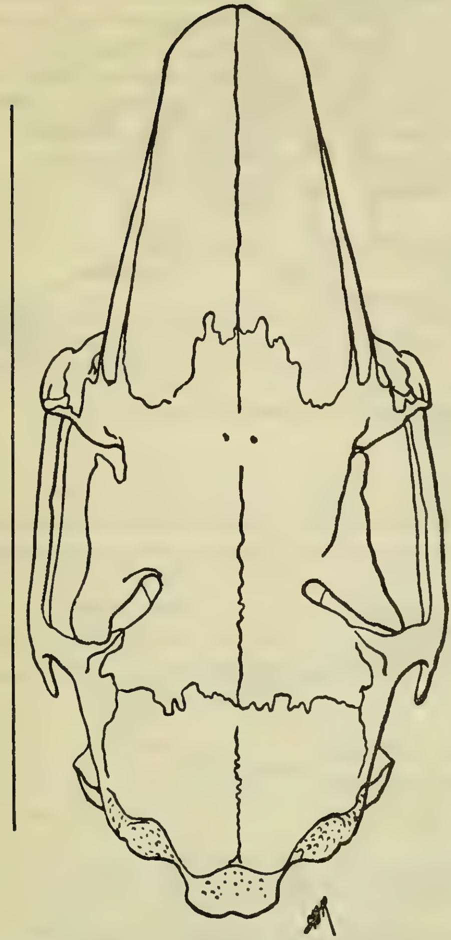

FIGURE 65. Skull of Lepus europaeus caspicus Ehrenb., No. M. 3021 ♂ 27 Jan. 1913, Khokhlatskoe, Astrakhan Counties, N. L. Chugunov, S. I. Ognev's collection

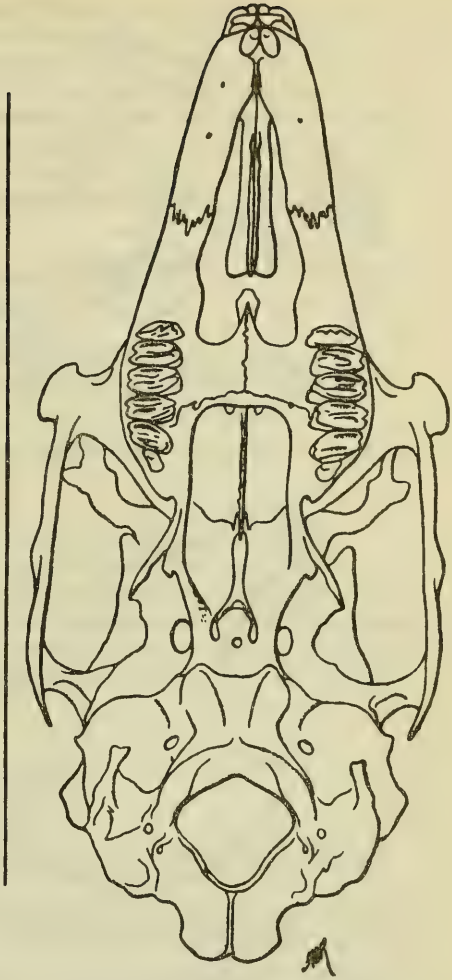

FIGURE 66. Skull of Lepus europaeus caspicus Ehrenb., No. M. 3021

Drawing by Yu. A. Kostylev

Comparison of the mandibula of the common hare and of L. timidus
116 shows very clear differences. As already stated above, the posteroventral plate of the mandibula from the angular process to the notch at the beginning of the horizontal process of the mandibula is weakly developed. In L. timidus this plate is strong and broad. The distance from the angular process to the notch at the beginning of the horizontal process of the mandibula is about equal, sometimes smaller than distance from the anterior alveolus of the first molar to the tip of the lower incisor. The first measurement is much larger than the second in the blue hare (see description of L. timidus.)

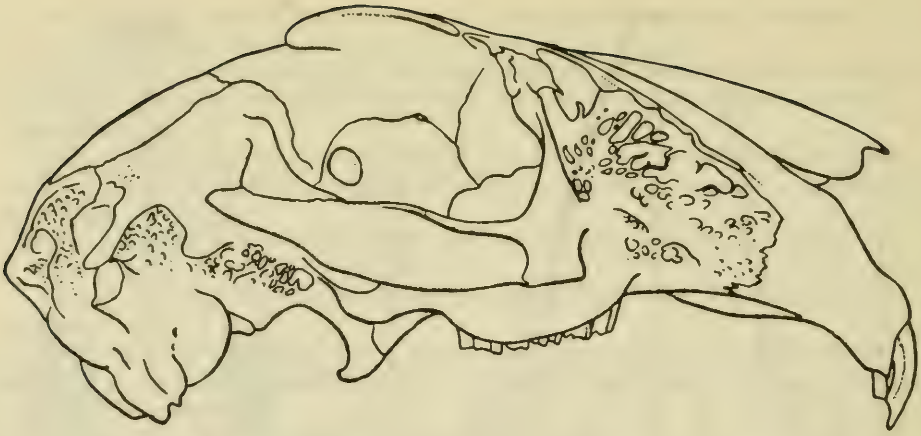

FIGURE 67. Skull of Lepus europaeus caspicus Ehrenb., No. M.3021

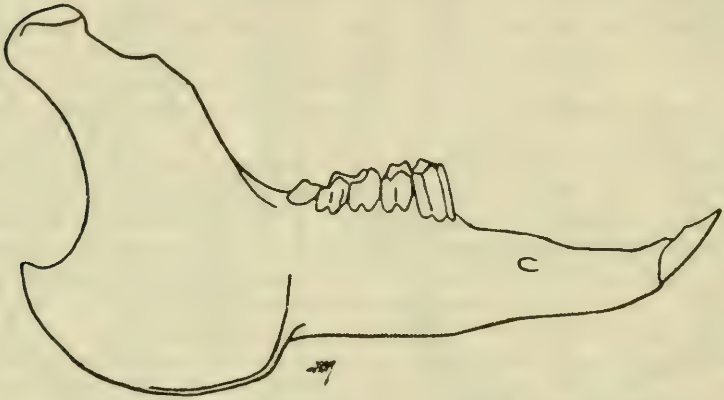

FIGURE 68. Mandibula of Lepus europaeus caspicus Ehrenb., No. M.3021

117 Yu. A. Filipchenko (1916) carefully analyzed 80 different cranial characters. He concluded that only 8 measurements are really characteristic for the skull of L. europaeus and L. timidus.* Yu. A. Filipchenko gives these 8 measurements in form of indices.

Indices:

	Lepus timidus	Lepus europaeus
1) Lateral length of brain case (from inion (occiput) to posterior margin of orbit and base of upper margin of zygomatic process of temporal bone) : Lateral length of facial part of skull (from alveolar point to middle of anterior or lower corner of orbit)	> 80	< 80
2) Length of bony palate : Width of incisive foramen	> 65	< 65
3) Length of tooth row : Length of diastema	> 65	< 65
4) Length of zygomatic arch : Oblique length of nasal bone	> 95	< 95

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* Yu. A. Filipchenko indicates the most salient characters. However, these 8 characters do not exclude the basic differences between these two species (see description and diagnosis of the common hare).

All these differences are relative, according to Filipchenko; a series of indices of one species may exceed the maximum or minimum of the measurements of another species, to a certain extent. Filipchenko analyzes the cranial differences by statistical methods. He compares variation ranges, taking into account the means of each series and the mean errors. The latter depend on the quadratic deviation of the series (σ) and on the number of terms in the series (n).

In order to calculate the quadratic deviation (provided the mean (M) is known), Filipchenko used the formula:

$$\sigma = \pm\sqrt{\frac{\Sigma \cdot p \cdot a^2}{n \cdot}},$$

in which a - deviation from M, p - number of terms in each class, Σ — summation symbol. After calculating the quadratic deviation, the mean error (m) can be determined because

$$m = \frac{\sigma}{\sqrt{n}}.$$

If the mean and mean errors of two series are known, it can be determined whether there are true differences between the two. The difference of the means of one series from the means of the other are

118 determined, i.e., the difference $M_1 - M_2$. The mean error of this difference is then determined, i.e., the square root of the sum of quadratic errors of both means, which is equal to the sum of the squares of the errors of both means, i.e., $\pm\sqrt{m_1^2 + m_2^2}$. We thus obtain the formula:

$$(M_1 - M_2) \pm \sqrt{m_2^2 + m_2^2}.$$

Comparison of the two sides of this formula shows whether two series differ.

If the difference between the means is much greater than its mean error, the ranges of variation differ. If, on the other hand, the difference between the means approximates the average error, there is no difference between the series, and the characters recorded are only apparent.

Filipchenko compares 8 cranial characters by this method. The following table shows the results of this analysis.

	Lepus timidus		Lepus europaeus		$(M_1 - M_2) \pm \sqrt{m_1^2 + m_2^2}$
		m		m	
Lateral length of brain case	1.1086	0.24	1.4130	0.26	2.04 ± 0.35
Lateral length of facial part of skull	1.7500	0.38	2.1775	0.40	1.77 ± 0.55
Length of bony palate . .	0.5117	0.11	0.6365	0.12	1.49 ± 0.15
Width of incisive foramen	0.6362	0.14	0.8094	0.15	1.50 ± 0.20
Length of upper tooth row	0.9338	0.20	0.7728	0.14	2.11 ± 0.24
Length of upper diastema	0.9698	0.21	1.4172	0.26	1.37 ± 0.33
Oblique length of nasal bones	1.9730	0.43	3.1059	0.57	3.17 ± 0.71
Length of zygomatic arch	1.7087	0.37	1.8874	0.35	1.78 ± 0.51

These figures prove that the difference between the means of both species is 3 to 10 times as large as the mean error.

There are thus clear cranial differences between the two species. The overlapping of the measurements and the relative characters of these differences are of no importance.

In addition, it may be remarked that the upper tooth row of L. europaeus is on the average shorter than that of L. timidus.

Filipchenko (1916) gives the following measurements of the upper tooth row:

Lepus timidus	Lepus europaeus
17.5 - 21 (M. = 19.28 mm)	15.5 - 18.5 (M. = 17.17 mm)

119 The color of the common hare varies considerably in different localities. The texture of the fur varies with the season. This is especially marked in the common hare from the northern and eastern parts of its range.

A description follows of the color of the summer fur of a central Russian common hare, and its geographical variations.

Anterior part of muzzle, head, forehead and occiput covered with dense, short fur which is generally yellowish clay in color with a more or less marked grayish brown tinge. Bases of hairs in this region very dark brown; subapical parts straw-clay-yellow (intermediate between pinkish cinnamon and light ochraceous buff); hair tips blackish, There is also some completely black guard hair.

Color of cheeks and sides of anterior part of muzzle more gray and whitish due to some hairs with a broad straw-whitish subapical band. Eyes ringed with light whitish ocher hair.

Middle part of broad inner margin of ear with relatively short black-brown hair mixed with hair with rust-straw subapical parts. A sharply delinated white stripe on the inner side of the ear, along the inner edge of the ear separated from the dark brown hair by an indistinct straw-yellow line.

Inner surface of ears with whitish gray hair. Margin of outer sides with an indistinct, narrow brownish gray stripe; base of outer side of ears with a narrow white stripe; apex of inner side of ears of dull rust-straw; tip of ear with a black-brown edge. Posterior side of ears covered with dirty-grayish white hair, with broad (to 55 mm) black-brown tips; clay-yellowish fur at the base of posterior side of the ears. The region posterior to the ears, upper part of back and flanks covered with long reddish rust-straw hairs (intermediate between cinnamon, sayal-brown, Ridgway, 1912, pl. XXIX, and wood-brown, pl. XL).

Upper part of back with wavy, curled hair of a clay-rust-straw tone with a black-brown tinge. The hair of this region consists of different types: a. guard hair with a gray-black base, broad yellowish rust-straw subapical band and black-brown apex; b. longer and denser guard hair with wider subapical bands and narrow apices in various parts of the back. There is also a predominant number of completely black guard hairs which make the fur more flexible and less silky.

Underfur woolly, dense, light pinkish straw (intermediate between pinkish cinnamon and light ochraceous buff). Bases of hairs whitish, their tips brownish gray.

Posterior part of back duller and more grayish than its middle part. A clay-rust-reddish stripe runs from flanks to groin (anterior part of hind legs), and a similar stripe runs across the chest. This color is
120 particularly marked on the chest; its general tone intermediate between pinkish cinnamon and vinaceous cinnamon. Throat white.

Color of anterior side of foreleg the same reddish rust-clay tone with gray streaks caused by gray-black hair. Color of hind legs more yellow, inner side whitish. Soles a dirty yellowish gray as the hair is always stained by soil.

Belly and groin white.

Ventral and lateral surfaces of tail with fluffy white hair; dorsal surface black or blackish brown.

The distribution of the vibrissae is generally constant, but deviations sometimes occur. The longest vibrissae are on the lateral parts of the muzzle, between eye and tip of nose. Each group of vibrissae consists of at least 28. The color of the longest vibrissae varies, their base is usually black and their tip broad and white; they may reach a length of 130 mm.

There is one, rarely two, long vibrissae behind the eye, in the lower part of the cheek. A group of four to five vibrissae is found above the eye. Finally, I found several specimens with two white vibrissae on the chin, close to the lower lip.

The color of the summer fur varies strongly in different localities.

Specimens from the Chernozem steppes of European Russia (L. e. tesquorum) have a duller earth color and less yellowish clay tones; those from the Astrakhan semidesert (L. e. caspicus) are a relatively light yellowish clay. Specimens from the Kalmyk area differ from Astrakhan specimens by their dirtier ocher-clay-yellowish color mixed with more gray-yellow tones, etc.

The winter fur of central Russian hares differs from the summer fur in being markedly grayer on the upper side of the body, which is caused by long hair with white bases, narrow black-gray subapical bands and very broad white tips, especially on the flanks and the lower part of the back. These hairs may be 65 mm long. Flanks and lower part of back whitish gray with a slight straw tinge. There are many white hairs among the ordinary guard hair; and also many hairs with whitish bases, dull straw or rust subapical parts and short blackish gray tips. Black-gray hairs are rare here. Hairs with rust-clay bands, and pure black guard hairs persist in the middle of the back; however, white hair also occurs here, giving the fur a more grayish color. Cheeks and area around the eyes
121 white; rust and clay colors persist on the forehead and occiput. Only small parts in the middle of the chest and on the flanks pale, reddish rust-clay; broad white hair tips give a lighter color to the fur in these parts. The anterior sides of the forelegs usually retain their typical reddish clay-rust color, hind legs usually white. Tail always black dorsally.

The color of the winter fur varies strongly. As a rule, it becomes paler and whiter from west to east. For example, Ryazan, Tambov and Saratov hares are much paler and whiter than Moscow hares. Hares from northern Kazakhstan (e.g., from the Kustanai District) are very pale and whitish. Southern hares (from the Crimea and Transcaucasia), and also hares from Kiev and Podolsk become only little paler in winter. A marked gray tone appears only on the lower section of the back, and on the cheeks.

SYSTEMATIC NOTES. There are 7 subspecies of the common hare in the the U.S.S.R.

The following races occur in western Europe; 1) L. e. europaeus Pall., from Denmark and the Atlantic Coast through central and western Poland, Germany to central France. This form was introduced recently into southern Sweden; 2) L. e. occidentalis de Winton, England and Scotland to the Orkney Islands in the north; 3) L. e. pyrenaicus Hilzheimer, the Iberian Peninsula, southeastern France; 4) L. e. meridiei Hilzheimer, southern and central France, North Italy, Corfu; 5) L. e. corsicanus de Winton (Corsica, Sicily, Italy; 6) Lepus e. transsylvanicus Matschie - Roumania, the Balkans, Peloponnesus*.

The systematic relation of the common hares to L. tibetanus, and to the small southern European species (L. mediterraneus Wagner.) will be discussed in the description of L. tibetanus.

GEOGRAPHICAL DISTRIBUTION. The range of the common hare has changed markedly during the last century. This species has continuously penetrated new localities, mainly in an eastern and northern direction.

A delineation of the northern boundary of the range of L. europaeus follows. The common hare apparently occurs only rarely in southern Finland, south of Savo, Istävä (vide J. Välikangas, 1909, D.J. Wadén, 1910). It is rare north of Leningrad. The boundary of the range runs to the northeastern coast of Lake Ladoga in the east, turning north of Petrozavodsk to the Medvezh'ya Mountain at the northern corner of Lake Onega. The boundary extends to Chekuev on the Onega river (its most northern point) in the east, reaching Penshinsk in the south, then turning south, passing near Plesetskaya** in the east, north of the town of Shenkursk on the Vaga river (a tributary of the Northern Dvina).

122 The boundary turns south from the town of Shenkursk, not reaching Veliki Ustyug. It crosses the Sukhona river, including the Nikolsk District. It crosses the upper reaches of the Mologa and Vyatka rivers. The boundary reaches the Kosa river (a tributary of the Kama river) in the Komi-Permyak Territory in the northeast. According to A.G. Tomilin (in litt. 1935), the boundary reaches 59°55'N here. It then turns to Perm, touches Kungur in the north, makes a large curve near the Ural Mountains, south to about 40 km north of Zalair, turns north again at Nizhne-Isetskoe Lake (in Central Trans-Ural). It thus makes a curve to Shadrinsk, Kurgan and runs east to the Tara river (in the Tobolsk Territory; according to B.F. Belyshev, in litt. 1934). This locality is the limit of the recent northeastern range of the common hare in West Siberia. The further course of the southwestern boundary of the range is not exactly known. O. 1. europaeus occurs in the Omsk, Petropavlovsk, Kokchetav, Atbasar regions, and the boundary then turns west to Turgai. Its course to the northern coast of the Aral Sea is unknown; it then runs east into Turkestan to the village Kara-Uzyak (west of Kzyl-Orda-Perovsk). This point is the southeastern limit of the range of L. europaeus (see Map II).

The southern boundary of the range of the common hare runs west of the Aral Sea through the Mugodzhary Hills, although not exactly known and then south of Temir. It can be traced to the estuary of the Ural and Volga rivers. It is distributed in the Kalmyk Region, along the western coast of the Caspian Sea to Transcaucasia and Azerbaidzhan. According to Blanford (1876) the common hare is numerous between Teheran and Isfahan, where the southern boundary of the range in Iran apparently passes. The boundary turns northwest and includes Asia Minor (M. Kollmann, 1918). The southern boundary in this country has not been determined. Further west the boundary passes the Balkan Peninsula (including Greece), the Apennine Peninsula (and Sicily, Corsica and Corfu), and finally, it includes southern France. A typical hare considered as a separate species, Lepus granatensis Rosenhauer, occurs on the Iberian Peninsula and in the Balearic Islands. This species has three subspecies on the continent. Small hares of the type of the common hare from Crete are also considered as a separate species (Lepus creticus Barrett-Hamilton); specimens from Sardinia are considered as the species L. mediterraneus Wagner. Hares from Parnassus (Liakoura) are considered as a separate species, L. parnassius Miller. The exact systematic relations of these species to L. europaeus Pall. will become clear only after the study of a large amount of material.

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* G.S. Miller (1912) records L. e. hybridus Desm. from eastern Germany, but with doubt. This race does not occur there at all, being replaced by the nominate race.

** [Now Plesetsk.]

A description of the distribution of the U.S.S.R. follows. In the northwest L. europaeus is common in some localities in the Leningrad Region. V.A. Bianki (1909) wrote that it was very common in fields and meadows near the coast of the former Peterhof [Petrodvorets] County. It is common near Novaya Ladoga and Narva. According to A.F. Kessler
123 (1868) the former Peterburg Province was the northern boundary of the common hare's range in the late 1860's. He remarks: "the common hare never enters the former Olonets Province." In their monograph on the common hare, S.S. Folitarek and A.A. Maksimov (1936) give data supplied by Sudnik, the Director of the Applied Zoology Section of the Karelian Scientific Research Institute. Sudnik wrote that the common hare appeared in Karelia between 1880 and 1890, gradually moving north. The northward migration of the common hare was apparently especially marked near the western coast of Lake Onega, a more densely settled region.
124 According to Sudnik, the common hare occurs in the following southern districts of Karelia: Medvezhegorsk, Kondopoga, Pryazha, Petrozavodsk, Sheltozersk, Olonets, Pudozhsk and Onega. It has not yet spread north of the Medvezhegorsk District. It is rare in the places mentioned, constituting about 1% of the population of L. timidus. It becomes gradually more numerous further south towards Lodeinoe Pole constituting 2 or 3% of the population of L. timidus. According to S.S. Folitarek and A.A. Maksimov (1936) the common hare occurs in small numbers in the basin of the Onega river east of the Priozersk District (Kenozero). It appeared here in 1916 or 1917, and had not been recorded previously. According to A.M. Korsakov (in litt, 1936) it is found along the Onega river to Chekuev and farther east in the Plesetsk District. The number of common hares caught in 1935 to 1936 constituted 0.68% of the number of L. timidus caught (94 common hares and 13,557 of L. timidus). It is very rare further east, in the Shenkursk District (on the Northern Dvina). According to S.S. Folitarek and A.A. Maksimov, only 10 common hares were found among 1706 blue hares examined in this region.

South of this region, in the Vologda and Novgorod territories, the common hare is rare and distributed sporadically, always less numerous than the blue hare. However, it is not rare near Cherepovets and Vologda, where it occurs in all isolated, more or less open localities. It is rare in the Sharya Region. According to A. A. Maksimov (1936) it is more common along the Vetluga river. It is, however, completely absent in forests only a few kilometers from the river. S. V. Lobachev (1930) reports that in the Vyatka]Kirov] Territory, the common hare keeps to the central, unforested parts of the former Vyatka Province. It is most numerous in the southern part of the Nizevskoe and the northern Porez forests. It occurs throughout the former Nolinsk and Vyatka Counties, in the central parts of the Kotelnich County and in the northern parts of the former Yaransk and Urzhum counties. According to A. V. Shestakov (1926) it was less common than the blue hare around 1860 in the Yaroslavl Territory. It now outnumbers the blue hare on the right bank of the Volga.

According to recent data by A. G. Tomilin (1934) the range of the common hare in the Komi-Permyak Territory reaches 59°55' N (near Yukseevo-Chazevo, in the Kosa District). It occurs only sporadically in the Kochevo District, on a few scattered fields. It disappears completely in the northern parts of this district which are covered by continuous forest. It becomes much more common in the Yurlinskii District. A. G. Tomilin adds that the common hare is in general much less common than the blue hare in the region between Vyatka and Kama (in the northern part of the former Vyatka Province and the northwestern part of the former Perm Province). It constitutes 10-12.5% of the population of the blue hare. There is no doubt that Lepus europaeus is spreading northward also in this region. L. P. Sabaneev (1874) remarked that the common hare was very rare in the former Okha and Osa counties of the Perm Province. A. G. Tomilin (1934) recently wrote that the common hare is not rare in this region, since as many as 1000 specimens per year were caught in the small area mentioned above.

B. S. Lukash (1929) gives some data on the upper reaches of the Kama Region. He says: "The common hare was found in the extreme northeast, in Verkhneuralsk, in 1926 only in the Gordino District (near the sources of the Kama, north of the Vyatka-Perm Railroad). It constituted 10% of the
125 total catch, 90% of which were blue hares. Only the blue hare is found in the Kai and Kirs districts, and in the Berezov Clearings. Members of the Omutinskoe Hunting Association shot only one common hare in 1928-1929 and 1930 blue hares. The zones adjoining the Omutinskoe and Sloboda Hunting Regions yielded 20% common hares and 80% blue hares in 1925-1926, according to data of the Glazov Agency of the State Trade Company."

The common hare does not occur near Cherdyn Kama, which lies halfway between Perm and Dedyukhino on the eastern boundary of the range of the common hare. According to S. S. Folitarek and A. A. Maksimov (1936) the common hare occurs south of Chermosskoe, reaching the Kama river. It occurs in small numbers on the right bank, in the Ust Garevskii, Selninskii and Shemeshevskii Rural Soviets. It constitutes less than 5% of the blue hare population. There are data which indicate that the common hare appeared in these places only in 1923-1924.

Distribution in the southern regions of the lower part of the Kama Valley and the central Volga Region. M. N. Bogdanov (1872) gives the following data on the distribution of the common hare in this area: "The common hare is constantly becoming more numerous in fields of the pine-forest region of the tertiary basin. It is not rare any more in fields of the clay belts of the Kazan province. This is especially true south of the Volga and Kama rivers. The northward migration of the common hare from the Kazan Province had already been observed by Eversmann. In a village not far from Kazan, a hunter confirmed the above and told me that the first common hare was killed in the winter near their village 40 years ago. It drew the general attention of the hunters, as they had never seen such a hare. It is now distributed throughout the eastern part of the Kazan Province to the Ashita river. It also lives in small numbers in the southern counties of the Vyatka Province. It is found in fields and in the spruce zone in the southwestern corner of the Kazan County."

The above shows how far north the common hare spread from its range in the former Kazan Province in the 1870's.

The common hare is widely distributed along the Belaya river although in the region of Izmailovo and Dyurtyuli it is much less common than the blue hare.

The common hare has actively spread to the mining regions of the Ural in recent years. It reached the Nyazepetrovsk District (in 1927) apparently from the west. It now occurs together with L. timidus at a rate of 8 blue hares to 2 common hares (out of 10) It also occurs in the N. Sergievskii Zavod Region. Out of 8000-10,000 hares shot here yearly, only 100 are common hares (S. S. Folitarek and A. A. Maksimov, 1936).

Thus the boundary of the range of the common hare in the regions near the Ural Mountains is not a straight line along the mountains, but an irregular curved line the course of which is not very clear. It may be sufficient at present to state that the common hare is gradually conquering new regions near foothills and uplands.

According to N. A. Zarudnyi (1897), the common hare abounds in the southern part of the Orenburg Territory and in the steppes in the middle reaches of the Ural river, between Orsk and Orenburg. It is very numerous
126 along the Obshchii Syrt, in the upper reaches of the Salmysh, and near the Chagan rivers. The common hare abounds in the former Orsk County, and in the former Ural Region, in B. A. Kuznesov's opinion (1928). According to M. K. Serebrennikov (1929) it is very rare in the northern Trans-Ural forest-steppe. It is much more numerous in the southern steppes, sometimes more common than the blue hare. S. V. Kirikov thinks that the northern boundary of its range in the southern foothills of the Urals passes 40 km south of Zalair.

According to S. S. Folitarek and A. A. Maksimov (1936) the common hare has recently become more numerous than the blue hare in the Verkhne-Uralsk district. According to Professor E. S. Danini (1931, 1933) the population of the common hare constitutes 65-75 % of that of the blue hare in the Troitsk District.

There is no doubt that the common hare has recently begun to spread eastwards.

According to A. M. Belyaev (1934) the range of the common hare reaches the Aktyubinsk Region in the east, to the Ural and Ilek rivers, i. e., the western outskirts of the Kustanai District. He assumed that the eastern boundary of the range is the eastern part of the Ural-Mugodzhary Upland.

These data are not quite accurate. It has now become known that the common hare occurs even farther into western Siberia and Kazakhstan. According to S. S. Folitarek and A. A. Maksimov (1936) common hares are widely distributed in the Turgai Territory, especially in the Kustanai

District and near Lake Ubagan-Dengiz. The Kustanai District Bureau gives the following data: the common hare was rare in this district until 1925, and only one common hare was obtained for every 10-15 blue hares; the population of common hares increased after 1925. In 1933-1934, 23,577 specimens of common hares were caught, and only 14,393 blue hares.

A.M. Korsakov (in litt. 1935) informed me that the common hare occurs not only in the Naurzum Reserve but also up to the boundary of the Akmolinsk [Tselinograd] Region. It first appeared in the Naurzum Pine Forest in 1915 (western coast of Lake Ak-Suat, 51°30' N and 64°29' E). It was only found 60-70 km further west previously, in the forest steppe of Sypsan-Agach and in the Teresek-Karagai Pine Forest. It was rare at first but became common in 1919-1920.

The range reaches east of Kustanai-Turgai. It appeared in the Atbasar District in 1932. In the Petropavlovsk District it appeared in 1933, when 150,000 blue hares and only 1000 common hares were shot.

The manager of the Akmolinsk [Tselinograd] Fur Stores informed S.S. Folitarek that the common hare appeared in the Akmolinsk District in 1931. It constitutes 0.1% of the number of blue hares at present. The Akmolinsk District should be considered as the extreme limit of the West Siberian range in the southeast (70° E.). B.F. Belyshev's observation (in litt. 1934) that common hares were caught near Tara (75°E) is an exception. It was recently found near Omsk (A.V. Fedyushin, 1937, in litt.).

The common hare was observed west of the Kustanai District and south of Orsk, near the Dzhurun Station (200 km south of Aktyubinsk) (A.N. Formozov, 1933). It is common in the Mugodzhary Mountains. 127

E.P. Spangenberg obtained the Caspian common hare between the Murun-Kudun and Tyulek wells (north of Kazalinsk) in June 1928. He definitely saw common hares in the desert steppe 35-40 km from the Chelkar Station in summer. He caught his first specimen here among dry bulrushes near Lake Dzhumarn-Kul, and the second in the marshes in the hills. E.P. Spangenberg found many common hares near Akbulokh and Sagarty Stations in May.

A skull of a specimen caught in 1921 by the expedition of Professor K.I Skrjabin near the Kara-Uzyak Station (45° N, 65° E) is in my collection.

The common hare is widely distributed in eastern Europe. It occurs in the Astrakhan semidesert, in the Kalmyk Steppe in the south Russian chernozem steppes, the forest steppe and deciduous forests, to the western border of the U.S.S.R. The distribution of the common hare outside Russia has been described above. It is very common in the Baltic Region (K. Grevé, 1909) although it was completely unknown in the former Livonia and Estland at the beinning of the last century. According to S. Chistovskii (1927) the common hare is common in the Pskov Region.

It is occasionally very numerous in the Odessa Region, the Tauric Steppes and in the Crimea.

It is very widely distributed in the northern Caucasus, from the belt of lowland-steppe to the foothills and high mountains. S.S. Turov (1926) recorded it from the Georgian Military Road near Kobi, in Siona, along the Terek river, near the village of Ozerakan, and in Tepi in the north Ossetian ASSR near the village of Zaromag. It is occasionally numerous in xerophytic mountain steppes of Dagestan. It occurs along the Black Sea Coast in Transcaucasia to the border of Asia Minor. It is widely distributed throughout Transcaucasia to the Mugan Steppe (K.A. Satunin, 1912).

The common hare has thus spread widely during the last century in a northern, eastern and southeastern direction. S.S. Folitarek and A.A. Maksimov (1936) in their monograph on the common hare show that this species increased its range during the last century by approximately 45%, over an area of about 180,000 sq. km.

In western Europe the common hare occurs in Great Britain (to the Orkney Islands), in Denmark, Poland, Germany, reaching the Iberian Peninsula, Italy, Corsica, Sicily, Roumania, the Balkans and the Peloponnesus in the south.

It was introduced repeatedly into North America (1888 and 1893), in the northeastern part of the U.S.A. and East Canada. Several lots from Hungary (about 500 specimens) were introduced into North America in 1910-1911.

The common hare has multiplied profusely in North America and become 128 acclimatized (James Silver, Journal of Agricultural Research, 1924; C.G. Goodwin, The Mammals of Connecticut State, Geological and Natur. Survey Bulletin, No. 53, Hartford 1935, pp. 159-162).

BIOLOGY. HABITATS. The common hare likes open country with sparse vegetation. In the central belt it lives in undergrowth and shrubs near fields, meadows, river valleys and gardens. It hides among weeds and in gullies. In the forest belt (where deciduous trees predominate), it avoids large forests, living only along their borders. It becomes gradually less common in the north, choosing places near large areas of felled forests or open river valleys. The increased exploitation of forests in the last ten years has been accompanied by an intensive northward migration of the common hare, usually penetrating new territories along the main highways and railways. The hares do not occur in the forest itself. They live near villages, threshing floors, barns and gardens in the north, to a certain extent living alongside man.

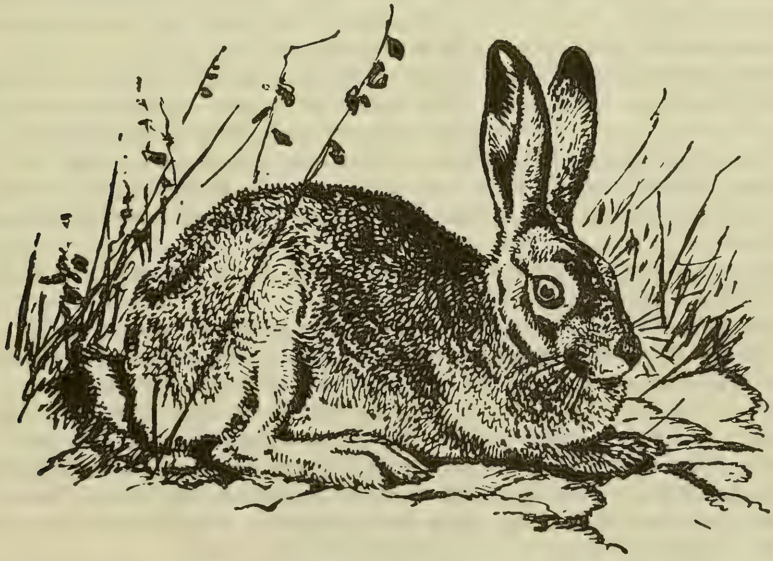

FIGURE 69. Common hare, Lepus europaeus Pall

Drawing by A. N. Komarov

The common hare is mainly found in ravines with oak shrubs (relicts of ancient forests) in the steppes of the central Chernozem Region, where, high grass and weeds grow in abundance. They prefer hard soil in the open steppe, where they are very common in fall. Such soil does not become muddy in the rain and does not stick to its hairy soles. It is very fond of weeds (such as in the Voronezh Steppe), mainly of Verbascum
129 lychnitis and V. orientale, and also of Artemisia. A resting hare may be closely approached, and sometimes jumps out under the feet of passing people. In the vicinity of the Dokuchaev Experimental Station in the Kamennaya Steppe of the central Chernozem Region (former Bobrov County of the former Voronezh Province) the common hare usually keeps to the open steppe in mild winters, rarely hiding in the bushes or forests characteristic of the steppe near the Dokuchaev Station. It takes shelter either among bushes or within the forest in severe winters. They also frequently live near villages in winter, to feed on threshing floors at night.

The typical habitat of the common hare in southern, semidesert steppes such as the Kalmyk Steppe is the hilly steppe (E.I. Orlov and B.K. Fenyuk 1927). It preferably lives here among weeds, and hillocks overgrown with Tamarix, Elymus arenarius, Xanthium spinosum etc. It is probably attracted by the easy shelter, and makes its shelters among shrubs and in hollows. Hares also occur in meadows near lakes. Orlov and Fenyuk often startled hares from heaps of last year's thistle (Salsola kali) in the Berovskie Hills. According to K.N. Rossikov (1887) the favorite habitats of the common hare in the northern Caucasus are brushwood, arable fields, pastures, weeds in the steppe, plains, river valleys, near forests, among shrub and loose thickets of reeds: and finally gardens and orchards near villages. K.N. Rossikov (1882) found the common hare in the barren sandy steppe inhabited by the Kara-Nogai nomads, southeast of the Kura. It occurs in the foothills and also in the high mountains. K.N. Rossikov (1887) writes: "One of my hunters killed an old hare which was a typical Lepus timidus Pall. while hunting Capra caucasica Güld. in the high mountains."

I found the common hare in the former Kizlyar Department, in the Terek Valley in the northern Caucasus. The hares were very numerous here in thickets of Elaeagnus. Hares are common in the foothills and in the xerophytic upland steppes of Dagestan. They also occur in the high mountain zone of the Caucasus, as recorded by K.N. Rossikov, in which it displays unusual dexterity in climbing steep cliffs although considered a plains dweller.

The above survey of habitats demonstrates the great adaptability of the species to different environments.

GENERAL DESCRIPTION AND HABITS. The hare is an active and graceful animal. Its sense of hearing is excellent, its sight is weak, but its sense of smell is apparently well developed. It runs rapidly. The steppe hares (L. e. tesquorum), usually called "feather-grass hares"
130 by the hunters, are particularly swift. Their speed may sometimes be considerable. According to I.I. Almazov ("Okhotnich'ya gazeta" (Hunter's Gazette) No. 2, 1928, p. 5) a hare ran in front of a train for 2 km. The speed of the train was 55-60 km. This hare had been first chased by a dog, but when the dog fell behind, it was "chased" by the train.

The track of the common hare differs markedly from that of the blue hare. Its feet are narrower, and the toes are not separated as widely as in the blue hare, which is more adapted to run over loose snow. The track of the common hare is therefore narrower, and the traces are more elongate.

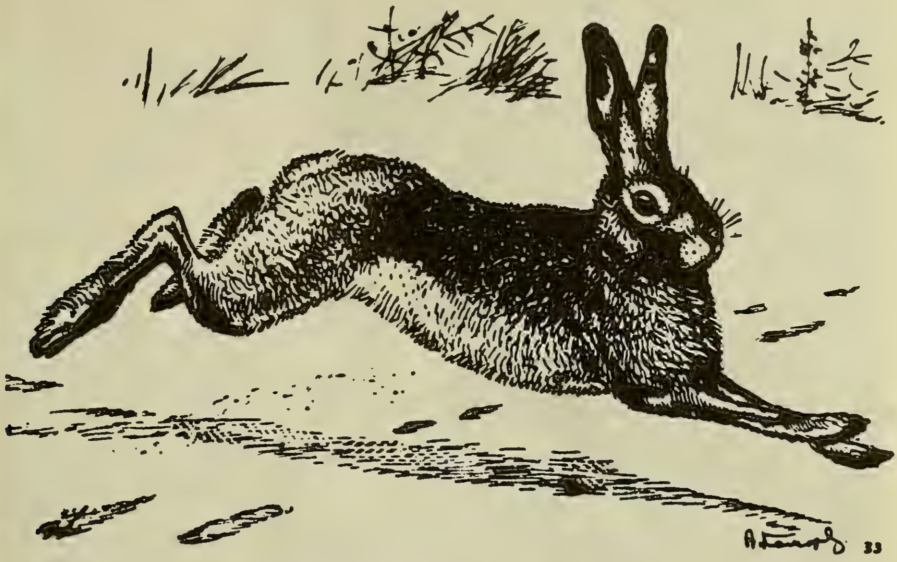

FIGURE 70. A common hare running. (Lepus europaeus Pall.)
Drawing by A. N. Komarov

The space between the footprints is also narrower than in the blue hare. The imprints of the forefeet (in normal slow gait) are more widely separated than in the blue hare. The whole group of imprints of the common hare in normal gait is more elongate*.

The fecal pellets of the common hare differ slightly from those of the blue hare; they are elongate with a sharp tip. They are about the size of a hazel nut. The pellets of the white hare are more oval, with broadly rounded tips and slightly compressed laterally.

The common hare is a good swimmer. I.S. Slesarev informed me that he saw a frightened hare jumping into a broad stream and swimming across. The ears were slightly inclined backwards. Its swimming capacity is,
131 however, limited because its paws are adapted to running, not to swimming. Many hares therefore die during the spring and summer floods after prolonged rains.

S.S. Folitarek and A.A. Maksimov (1936) write: "Many hares, especially common hares, die during the high floods. The sharp decrease of their numbers after the floods has a marked effect on the results of hunting in fall.

"We had the opportunity to see the great influence of spring floods on the hare population in 1933, in the lower reaches of the Tsna river, from Sasovo to the inflow of the Tsna river into the Moksha river, and from Kadym to the mouth of the river. There was a great flood in 1932, 10-15 km wide on the Tsna and Moksha rivers. There were nearly no hares in these places in 1933, although conditions in general were favorable.

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* The differences between the track of the hare in slow and rapid progression, and the description of turns and loops are given in the chapter on the biology of the blue hare.

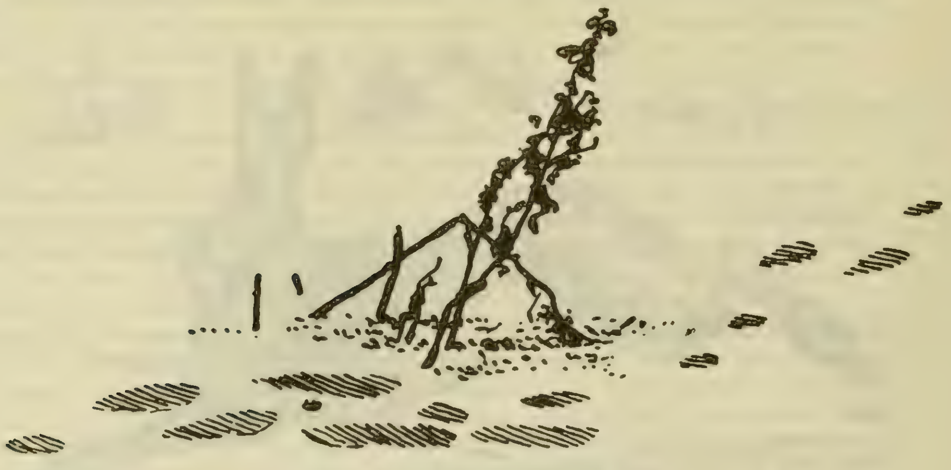

FIGURE 71. Tracks of the common hare in the snow
Drawing by A. N. Formozov

"We found shreds of fur and the bones of hares in two places in osier-beds near the water where drowned hares apparently became lodged. We were informed that hares are widely hunted in spring in this area. Hunters in boats in the flooded forest searched the wooded ridges and frightened hares on them. The animals jumped into the water and were killed with sticks."

I know of many cases in which hares died in the floods, unable to swim long enough.

DAILY LIFE. Although the hare is occasionally active during the day, it is mainly a crepuscular animal. It comes out to feed after sunset, and remains active until dark. It continues feeding and moving about at night in winter, leaving its tracks in the snow. Early in the morning, before and 132 after sunrise, before the dew disappears and the heat begins, hares can be seen moving about and feeding. It usually rests during the day in its shelter among vegetation. In the steppe it is found in thickets of weeds and shrubs.

It is interesting to watch the hare feeding on the steppe and to observe the habits of this animal the life of which is full of perils.

I wrote in my diary of the Voronezh expedition (1922): "I watched a hare feeding in the evening between patches of forest in the Kamennaya Steppe. I was trying to approach it when something unexpected and rather funny happened. Two swallows appeared. Apparently mistaking the hare for a cat, they attacked it with loud cries and with the same vigour with which they attack cats. The hare ran away as fast as it could. It stopped for a moment from time to time, and when the swallows repeated their attack it ran away again."

I saw a fox chasing a hare in the Kamennaya Steppe on 15 July 1922 in the evening. The fox soon gave up. The hare stopped for a moment and resumed its rush. It then stopped near a marmot burrow from which a

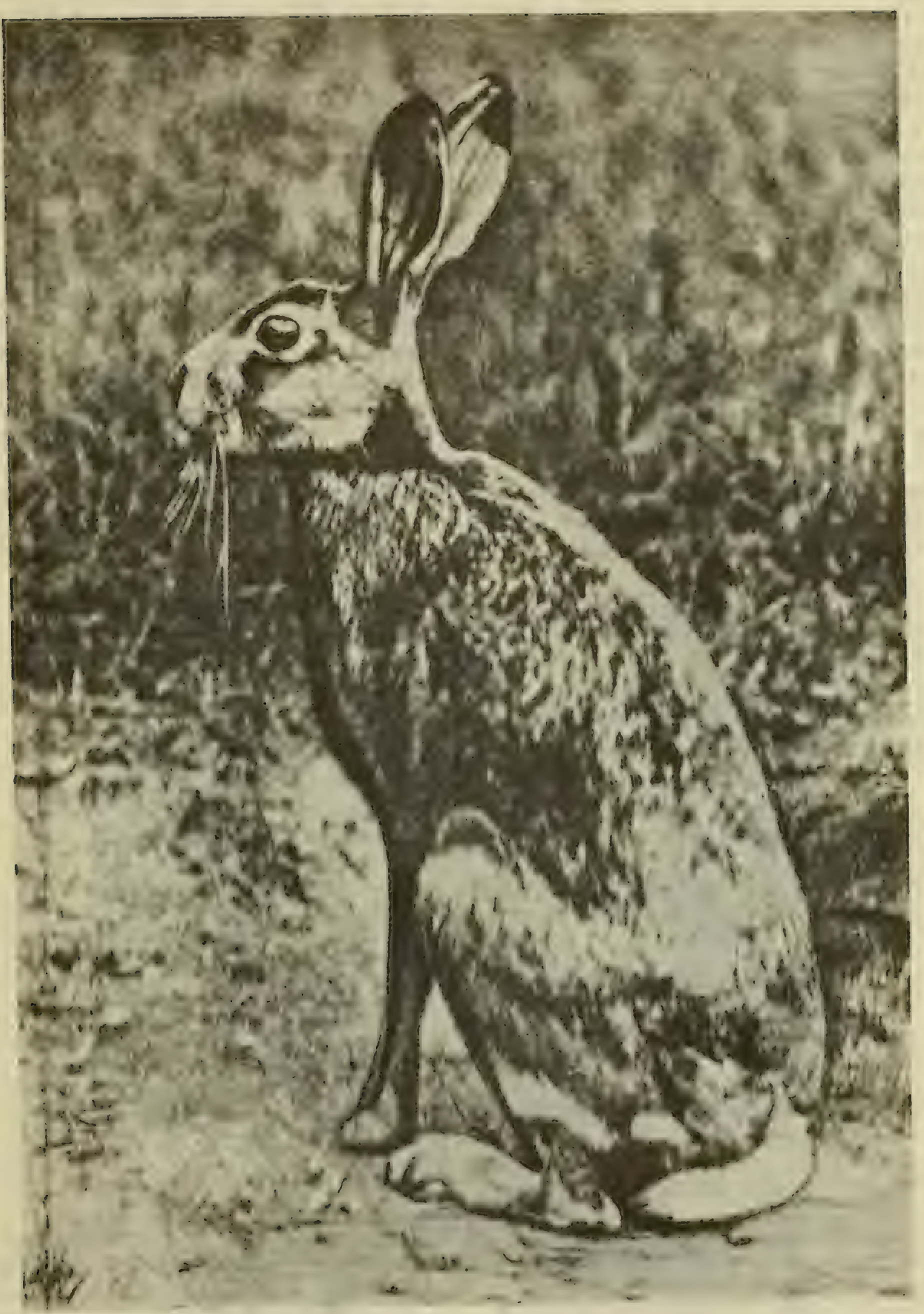

FIGURE 72. Common hare in summer

Photograph by S. I. Ognev

large old marmot emerged. The hare sat down 5 steps from the marmot and raised its ears and forefeet. Both animals eyed each other in dumb surprise for some time and then the hare dashed into the open steppe, fleeing from the dangerous spot."

BURROWS AND LAIRS. As has been said, the lairs of the common hare are usually in "secure" places, under bushes, in thickets of high grass and weeds, overgrown wheat fields, underbrush in ravines, tamarisk thickets in the semidesert etc. It thus has generally no permanent refuge. It often burrows in the snow under a shrub and rests there during the day. In sandy and semidesert areas, it sometimes deviates sharply from its typical habits. For instance, A.N. Formozov found southern common hares living in burrows dug in the sand on Dzharylgach Island in the Black Sea between the Crimea and the Dnieper estuary. I.I. Barabash-Nikiforov (1928) writes that in the Sivash Steppes hares are frequently attacked by sea eagles (Haliaëtus albicilla). They therefore often dig burrows in the snow which may be 1.5 m long. In one case, a burrow had 2 lairs together at the end of the tunnel.

A chased or wounded hare sometimes finds shelter in an old marmot burrow in the steppe. Hares may hide in fox burrows in the central forest.

According to V.N. Kaverznev (1928), "hares sometimes use abandoned burrows of foxes. I saw a wounded hare hiding in a burrow so that I could 133 not reach it."

FOOD. P.A. Manteifel (1927) writes: "The food of the common hare is more nourishing than that of the blue hare in the forest. As it lives near settlements, it visits gardens, digs up vegetables in winter, enters hay barns, feeds on haystacks, gnaws cabbage stumps in gardens, and in the February-March frosts it walks on the hard snow and enters orchards where it gnaws the bark of fruit trees, often causing great damage."

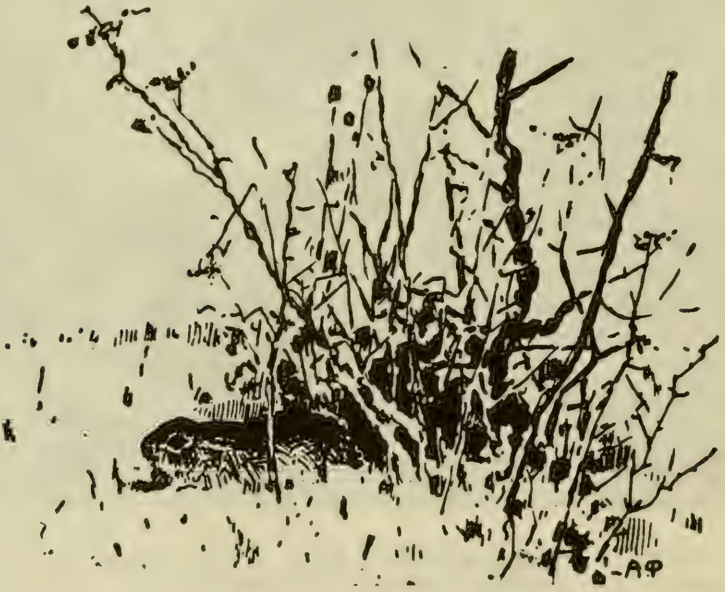

FIGURE 73. Common hare hiding in winter

Drawing by A. N. Formozov

A.I. Yurin (in litt. 1934) informed me that the common hare is very fond of Helianthus tuberosus.

He wrote: "I found a new method of catching hares. Blinds are erected in Helianthus plantations, or near stalks of Helianthus placed for this purpose. Helianthus left in the field in winter is one of the favorite foods of hares."

A small hare which I kept accepted sage (Salvia silvestris), plantain, wintercress (Barbarea vulgaris arcuata), peas, potatoes, and knotgrass. It also liked bread moistened with milk. When eating a plant, the hare does not hold it with its forelegs as other rodents (e.g., marmots) but seizes the food with its mouth. 134

REPRODUCTION, YOUNG AND THEIR DEVELOPMENT. Our knowledge of the reproduction of the common hare is even more incomplete than of that of the blue hare.

The female produces 3 or 4 litters from spring to fall; each litter usually consist of 3-5, rarely of 7 young.

The first litter is normally born in March in the Moscow Region, and the last litter in September (rarely in October). But these dates vary greatly with the climate. Thus, I.S. Slesarev (in litt.) informed me that he shot a gravid female near El'nya (in the former Smolensk Province) in the mild winter of 1925 on 15 January.

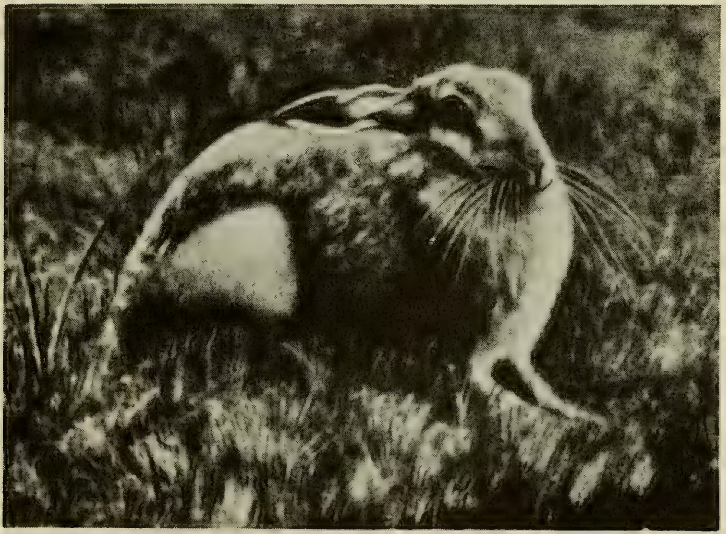

FIGURE 74. Common hare sitting

Photograph by S. I. Ognev

E.V. Sharleman (1915) observed rutting hares near Kiev in late February. He saw several males chasing a female at midday on 20 February 1912, completely ignoring people. In Sharleman's opinion, copulation may take place even earlier, because he had already seen newborn hares in March. He found young in March 1913 which were half the size of adults. He found newborn hares in the same year, on 28 March and 15 April. K.F. Kessler usually found the first newborn hares in the

Kiev Province in late February, when the ground was still covered with snow. E. V. Zverezomb-Zubovskii (1923) found the last litters in late September near Rostov-on-Don. K. N. Rossikov (1887) saw newborn litters in 1882, 1883, and 1884 in North Caucasus near the Cossack village of Prokhladnaya in early April, early June and late August to early September.*

The exact period of gestation of the common hare is unknown ** According to E. V. Zverezomb-Zubovskii (1923) the young may be nursed for 8 weeks.

P. A. Manteifel' (1935) gives the following data on the reproduction of the common hare:

"The blue hare brings its young to open places where they scatter in all directions. On the other hand, the common hare in the open country digs a shallow pit in which the young hide from raptors.

"The common hare feeds its young more frequently and protects them more energetically, especially when they cry. I found that the presence of

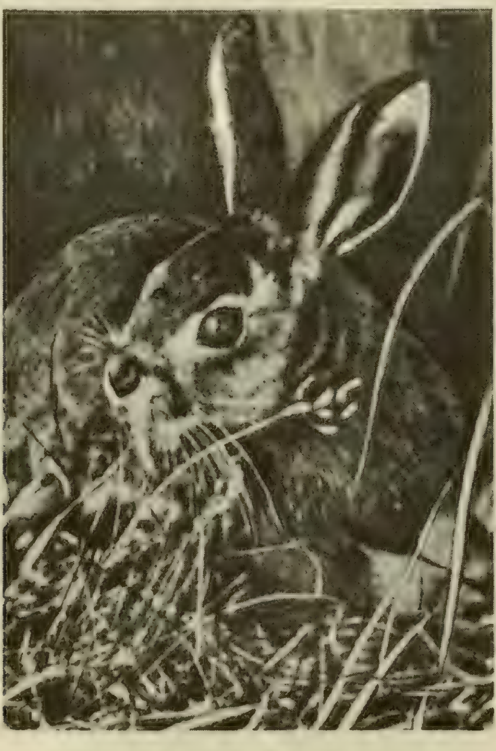

FIGURE 75. Young common steppe hare, Lepus europaeus tesquorum Ogn., Kamennaya Steppe, former Voronezh Province
Photograph by S. I. Ognev

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* We converted Rossikov's dates to the New Style.

** E. A. Manteifel' informed me that the gestation period is 44-46 days, i. e., shorter than in the blue hare, according to observations in the Moscow Zoo.

young of previous litters is fatal for newborn hares. The older specimens 136 consume all the milk of the females. The females let the young feed, without touching them or driving them off. Common hares apparently change places for different broods, to prevent starvation of the newborn. Mass multiplication of hares usually gives rise to epidemics of infectious diseases."

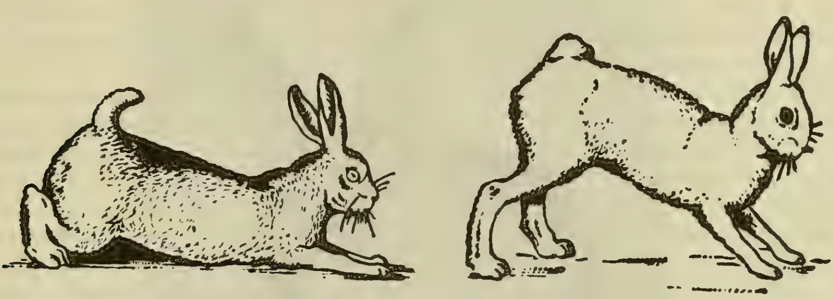


FIGURE 76. Postures of females of common hare (left) and the blue hare (right) during copulation.
After P. A. Manteifel'

MOLT. The fall molt usually starts in early October and ends in late November in the Moscow region. The spring molt is more rapid, lasting from April to early May.

MIGRATION, DISPERSAL AND FLUCTUATION OF POPULATION. We described the wide dispersal to the north, east and southeast in the survey of the geographical distribution. S.S. Folitarek and A.A. Maksimov (in litt. 1936) showed that the range of the common hare increased by approximately 45% during the last century, as it occupied an area of about 180,000 sq. km.

The fluctuations in populations are discussed in detail in the description of the biology of the blue hare. At present, it should only be noted that these fluctuations show a certain periodicity.

In the southern and southwestern regions of Russia, population fluctuations take place at intervals of about 5 years. This corresponds to the observations of Biger (1928) in Germany, in forests in Mecklenburg-Schwerin.

Fluctuations of populations of the common hare are not as great as those of the blue hare. According to A.N. Formozov (1935) common hare populations fluctuated between one and ten in the Crimea, between one and seven in the Leningrad Region, between one and six in the Ivanovo Region and Bashkiria, one and three in the Gorki (former Nizhni Novgorod) Territory and Tataria etc. A.N. Formozov gives the following explanation for the smaller fluctuation of the populations of the common hare: 1) a more uniform and regular exploitation of the population by hunters; 2) the relative immunity of the common hare to diseases because it lives in drier country than the blue hare. The second factor is of greater 137 importance in our opinion.

There are many factors which regulate the populations of the common hare. It is difficult to define them and to evaluate their relative importance.

The following factors regulate the population of hares:

1) Strong floods, which will be discussed in detail in the description of the blue hare. It should be stressed that the common hare prefers river valleys in the forest belt and spreads north along them. However, this preference for river valleys is often fatal for them during strong spring floods.

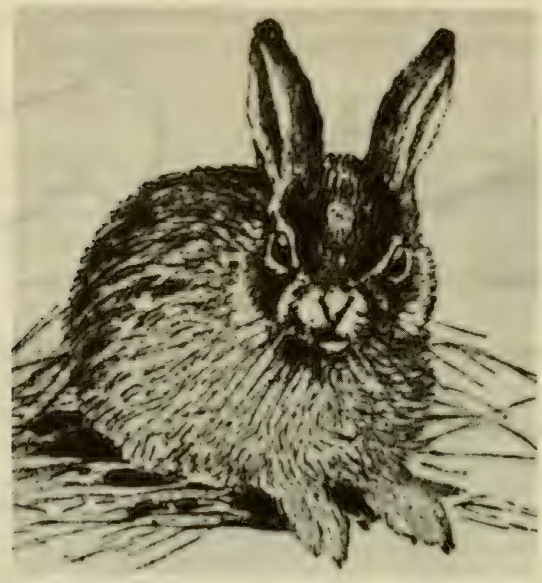


FIGURE 77. Young Crimean common hare, Lepus europaeus transsylvanicus Matschie

Drawing by A. N. Formozov

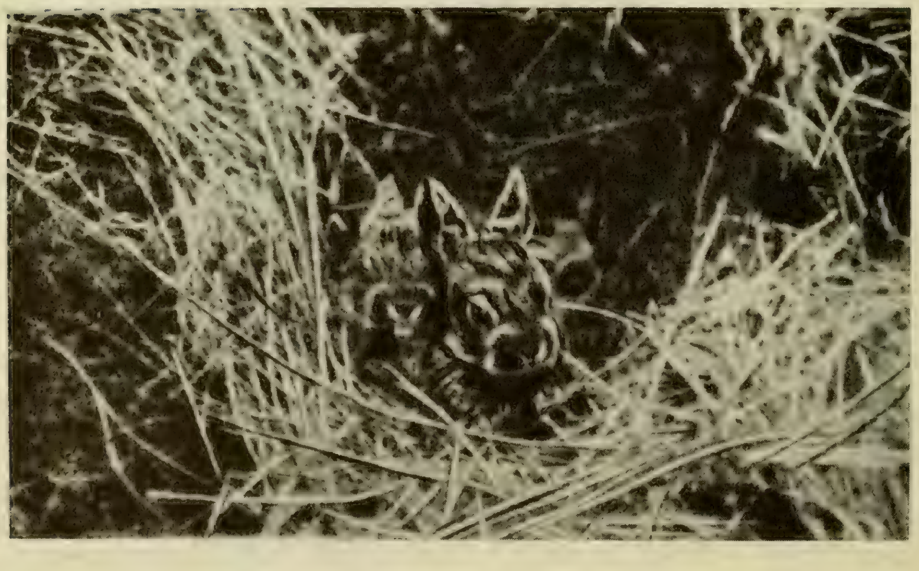


FIGURE 78. Nest of common hare with young

Photograph by S. I. Ognev

2) As the common hare lives in open country, it is less endangered by forest fires than the blue hare.

3) Cold spells in spring after the onset of warm weather are often fatal for the young of the common hare.

S.S. Folitarek and A.A. Maksimov (1936) state: "The common hare is of southern origin. After having moved north, it retains the reproduction rhythm of more southern latitudes. The northern summer is short, and the hares reproduce in haste. We often found litters which were born too early or too late, and which thus had to die. This happened most frequently in spring when the onset of hot weather is followed by sudden cold snaps (often with snow). The first litter of the common hare often dies during 138 these short periods of cold. This also happens during long cold springs. There are records of mass mortality of hares in the spring of 1905, 1927-1928 and 1931. Warm April weather was followed by severe cold in the first days of May in 1933 near the Moksha river in the Moscow Region. Water was iced over in the morning and snow fell on 6 May. A local hunter found four newborn hares in a meadow near the village of Koshebeevo at that time. Two of them were already dead, and the others were frozen. The hunter took them home, warmed and revived them."

4) S.S. Folitarek and A.A. Maksimov (1936) skeptically quote stories of mass mortality of hares during severe winters as a result of blizzards, snow and starvation. This is correct, but rare. The influence of the climate is increased by indirect factors. For instance hunting by man is intensified as exhausted and starving hares enter settlements and villages. B.K. Fortunatov (1929) gives very interesting illustrations of this phenomenon.

He writes: "The year 1927 was very favorable for the hares throughout the Ukraine. Their population increased considerably in fall.

"The first half of the 1927-1928 winter was relatively mild and there was little snow. However, on the night of 3rd February a savage blizzard broke out in Ascania-Nova which covered buildings and parks with snowdrifts.

"We concentrated all our efforts in the first two days to dig out all zoo animals which had been buried by snow. It was impossible to go into the steppe, as this meant certain death. However, the wind subsided and snow ceased to fall in the night of 4-5 February.

"The night was clear. The full moon illuminated the steppe which was covered with thick snow. I stood on a mound of snow under which the sheds of the American bisons were buried. We noticed black chains moving towards us from all directions one hour after sunset. We realized that they were hares fleeing from starvation. The courtyard of Ascania-Nova was thronged with thousands of hares in half an hour.

"As a result of the shock suffered in the steppe, or due to hunger, the hares had almost completely lost their fear of men. They ran at our feet, fell greedily upon every scrap of fodder, and hundreds huddled near haystacks at the borders of the estate. During the same night, we carried several haystacks to the steppe, and thousands of hares were thus saved.

"The wind calmed down the next day, and we found many dead hares upon examination of the steppe. Not all of them had died of hunger. Even a few days later, dead hares were still found in Ascania-Nova where there was sufficient food. Such a severe blizzard was apparently sufficient to kill even the best adapted wild animals.

"Ascania-Nova attracted and saved only a relatively small part of the hares. Most of them headed for the hamlets and haystacks near them. They were all killed by the peasants, as the bright moonlight enabled them to shoot as easily as during the day. An even greater number of hungry
139 and desperate animals were killed with sticks. Hunters carried away hundreds of hares caught during the night.

"The February events could be summed up a month later. Several thousand hares obstinately remained near Ascania-Nova, not moving more than one kilometer away. No hares were found beyond this line. I saw tracks of hares only twice in late February, on the 70 km between Ascania-Nova and the Novaya Alekseevka Station."

5) Epizootics decimate hare populations, both of common and blue hare. We will discuss the magnitude and characteristics of these epizootics in the description of the biology of the blue hare.

The mortality of common hares as a result of epizootics is intensified by climatic factors. Mortality is increased in winter by: 1)deep snow which hampers the movements of the narrow-footed common hare, and exhausts it; 2) snowstorms (see above); 3) severe frosts; 4) iced-over ground. Common hares contract diseases more easily during very rainy summers.

DAMAGE. Damage to crops caused by hares is negligible in summer because of the large size of the fields, but when deep snow falls in the steppe and buries the vegetation, the hares migrate to the villages. If they feed on straw and hay, the damage is small, but if they enter orchards and gnaw bark of trees and the young tree tops in plantations, the damage becomes more severe They cause great damage to fruit orchards and vineyards in the Crimea and the Caucasus.

The common hare is less numerous than the blue hare in the forest and is less widely distributed there than in the steppe. The damage it causes is therefore negligible. V.N. Kaverznev (1928) correctly states that the common hare can be made harmless by rational methods. This can be attained by supplementary feeding, putting out boxes with fodder, stumps, and rotten cabbage leaves. Such supplementary feeding would avert its harmful activity in severe winter and would prevent its destruction as a pest.

ENEMIES. It is usually assumed that the fox is one of the main enemies of the common hare. However, the hare does not occupy first place in the diet of the fox. I.I. Zharkov, V.P. Teplov and V.I. Tikhvinskii (1932) examined the excrement of 508 foxes in Tataria. Remains of hares were found only in 12.6%, but remains of small rodents (mice and voles) were found in 49.2%; hamsters in 28.9%, of susliks in 17.5%, of birds in 11.2%, of insects in 17.7%, carrion in 2.6%, and amphibians in 0.8%.

The common hare is hunted by wolves. It may be chased by the lynx
140 in the forest zone, which it occasionally enters, but the lynx feeds mainly on blue hares. Stray and shepherd dogs cause great damage to the common hare.

Goshawks, golden eagles, spotted eagles, Aquila clanga, and rarely sea eagles and eagle owls prey on hares. I.G. Pidoplichka (1930) found only remains of one hare among remains of 22,000 animals in excrement of owls and came to the conclusion that owls do generally not prey upon hares.

COMMERCIAL VALUE. We shall discuss the great commercial value of hares for the fur trade of the U.S.S.R. and as food in the description of the blue hare. It should only be stated here that the supply of fur varies considerably in different years. According to B.A. Kuznetsov (1932) the fluctuations compared with 1924-1925 (taken as 100%) ranged between 100-335.5%. Pelts of the common hare constitute 1.6-5.6% of the total Russian fur trade.

Subspecies of Lepus europaeus

327. Lepus (Eulagus) europaeus europaeus Pall. (1778). European common hare

1756. Le Lièvre. Daubenton L. J. M., in E. L. le Clerc, Comte de Buffon. Histoire Naturelle, VI, pp. 264-299 (described from a specimen from Burgundy, France).

1777. Lepus timidus (nec Linnaeus!). Erxleben J. C. R., Systema Regni Animalis, p. 325 (partim!).

1778. Lepus (europaeus) Pallas P. S., Novae Species Quadrupedum e Glirium ordine, p. 30 (terra typica not stated).

1801. L[epus] t[imidus] albus Bechstein Joh. Matth., Gemeinnütz. Naturgesch. Deutschlands nach allen 3 Reichen, I. Editio 2, S. 1096 (Thüringen, Germany).

1801. L[epus] t[imidus] flavus Bechstein Joh. Matth., Op. cit., S. 1096 (Thüringen, Germany).

1801. L[epus] t[imidus] niger Bechstein Joh. Matth., Op. cit., S. 1097 (Thüringen, Germany).

1811. Lepus timidus (nec Linnaeus!). Pallas P. S., Zoographia Rosso-Asiatica, pp. 148-149 (Poland and Lithuania).

1857. Lepus timidus (nec Linnaeus!). Blasius J., Naturgeschichte der Säugethiere Deutschlands, S. 412, 417 (Mittel-europäische Form L. timidus auct., L. campicola Schimp.).

1859. Lepus campicola Gervais P., Zool. et Paleontol. française, Editio II, p. 47 (Nomen nudum! It describes a hare in France).

1867. Lepus timidus: coronatus, rufus, cinereus, nigricans, maculatus, albus et niger. Fitzinger L., Sitzungl. d. Kaiserl. Akademie der Wissensch., Wien, Mathem. Naturwissensch. Klasse, LVI, S. 161 (Nomina nuda! Hares from Austria are described).

1910. Lepus europaeus Pall. Trouessart E. L., Faune des Mammifères d'Europe. Berl., S. 219.

1912. Lepus europaeus europaeus Miller G. S., Catalogue of the Mammals of Western Europe, pp. 502-504.

TYPE LOCALITY: G. S. Miller (1912) proposed to consider Burgundy (France) as the terra typica of L. e. europaeus for the following reasons: 1) in Pallas "Novae species glirium", p. 2, reference is made to the description of Daubenton in "Histoire Naturelle" of Buffon; 2) in Miller's opinion (op. cit. p. 5) Pallas had another form in mind when he discussed the distribution of the hare in Poland; 3) Pallas does not mention the distribution of the common hare in the very short description on p. 30.

Pallas quite casually mentions a hare measured by Daubenton, on p. 2. He mentions — doubtfully — a hybrid between L. variabilis and L. europaeus found in Poland and Lithuania on p. 5 ("... hanc, mihi vix dubium est, varietatem vere hybridum esse productum, ex adulterio L. variabilis cum L. europaeo, australiorem Poloniam atque Pannoniam occupante, progenitam et in istis regionibus multiplicatam...").

In his "Zoographia Rosso-Asiatica", 1811, p. 148 Pallas gives the range of the common hare (Lepus timidus) precisely and clearly: "In Rossiae australibus, ultra 55 tum latitudinis gradum, haec sola species occurrit, ut et in Polonia et Lithuania...".

E. L. Trouessart (1910) was correct, in our opinion, in stating that the terra typica of the common hare is Poland.

We consider southwestern Poland as the type locality of the nominate race, where hares with well marked characteristics of the type are found.

MATERIAL EXAMINED: 7 pelts and 4 skulls.

DIAGNOSIS. Fur on back wavy, slightly curly, clay-rusty-yellowish, without a dull earth-gray and black tinge. Color of winter fur hardly different from summer fur; only the lower part of the back is slightly grayer.

Length of skull usually less than 100 mm; hind feet less than 150 mm (usually about 140 mm).

ADDITIONAL DESCRIPTION AND SYSTEMATIC NOTES. Color, waviness and curliness of summer fur of the typical common hare does almost not differ from that of central Russian hares (L. e. hybridus).

The winter fur of the western common hare differs sharply from that of L. e. hybridus. The color of the winter fur of L. e. europaeus hardly differs from that of the summer fur, the former is, of course, denser, longer and softer. The winter fur of L. e. europaeus lacks gray hair; there is occasionally a slight gray tinge on the lower part of the back, near the tail.

I gave a detailed critique of the color characteristics of the nominate and central Russian races given by Hilzheimer and Trouessart in "Mammals of the Moscow Province" (Mlekopitayushchie Moskovskoi gubernii), 1913, p. 292-293. I confirmed, provisionally, the following data given by Hilzheimer (1908) on the basis of the small material at my disposal: 1) shoulders of the German common hare compared with that of the central Russian race much darker reddish brown with a marked clay tinge; 2) anterior sides of forelegs of German hare duller, with more brownish tones and with numerous black hairs. Since then I re-examined many common hares and found that black hairs on the anterior parts of the forelegs also occur in L. e. hybridus. On the other hand, I saw typical common hares from Germany without such black hair.

L. e. europaeus is clearly distinguished from L. e. hybridus by the small size of body and skull, and characteristic color of its winter fur. L. A. Obrecht informed me that of a large number of central German hares examined none weighed more than 3.5-5.8 kg. This is much less than the weight of L. e. hybridus. 142

I am inclined to consider hares from the vicinity of Novaya Aleksandriya [Pulawy] and Kiev (vicinity of Pochapenets, Zvenigorodka District) as intermediate between L. e. europaeus and L. e. hybridus. These specimens resemble L. e. europaeus in the small difference in color of winter and summer fur, and in the slight gray color of the lower part of back and cheeks. Their measurements are identical with those of L. e. hybridus.

The characters of L. e. europaeus are particularly well marked in specimens from its western range. Thus, German common hares are smaller than Polish, and French specimens are smaller than German common hares (E. L. Trouessart, Faune des Mammifères d' Europe, 1910, p. 219).

Measurements of L. europaeus europaeus: length of skull 89-99 mm (M. 97.7 mm); condylobasal length 84-87.7 mm (M. 86.4 mm); zygomatic width 44-48 mm (M. 46.1 mm); length of nasals 44-47 mm (M. 44.4 mm); width of nasals 16-17 mm (M. 16.9 mm); length of bony palate 6.1-6.4 mm (M. 6.2 mm); width of incisive foramina 11-12 mm (M. 11.4 mm); length of upper tooth row 17.0-17.6 mm (M. 17.4 mm).

G. S. Miller (1912) gives the following cranial measurements for the typical subspecies: occipitonasal length 94-102.2 mm; condylobasal length 85.2-92.2 mm; zygomatic width 45.2-50.2 mm; interorbital width 18.4-24.8 mm; postorbital width 11.4-15.2 mm; width of brain case 31-34.6 mm; length of nasals (along oblique outer margin) 42.2-46.2 mm; maximum width of both nasals 20.6-24.6 mm; diastema 26.8-31.8 mm;

length of upper tooth row 17.2-19.2 mm; length of lower tooth row 18.6-20.2 mm.

Measurements of specimens. 1) From Hasley, Zealand (Denmark) 2 males ad. and female ad.: length of body 660, 680 and 640 mm; tail 80, 82, and 74 mm; hind feet 136, 147 and 138 mm; ears (measured from occiput of live specimen) 138, 131 and 125 mm. 2) Rheinhessen, Ingelheim (Germany) male ad.: length of body with head 571 mm; tail 98 mm; hind foot 135 mm; ear (measured from occiput of dried skin) 120 mm. 3) Rheintal, St. Gallen (Switzerland) 2 males ad.: length of body with head 570 and 540 mm; tail 100 and 85 mm; hind foot 136 and 137 mm; ear (measured) from occiput on pelt) 117 and 115 mm. 4) Verdenberg, St. Gallen (Switzerland) 2 males ad.: length of body with head 600 and 605 mm; tail 90 and 95 mm; hind feet 145 and 144 mm; ear (measured from occiput) 114 and 118 mm.

GEOGRAPHICAL DISTRIBUTION. The nominate subspecies occurs in central Europe from the Atlantic Coast of Denmark to Central France, and also throughout Germany, Austria, and Switzerland. It is also found in western and central Poland (E.K. Lubicz-Niezabitowski, 1934).

According to G.S. Miller (1912) this form has been recently introduced into southern Sweden.

328. Lepus (Eulagus) europaeus hybridus Pallas (1811).
Central Russian common hare

1811. Lepus variabilis var. hybrida Pallas P., Zoographia Rosso-Asiatica, pp. 147-148.

1820. Lepus hybridus Desmarest M. A., Mammalogie ou description des espèces de Mammifères, I. Paris, p. 349.

1842. Lepus aquilonius Blasius I., Amtl. Bericht XIX Versamml. Naturf. und Aertzte, Braunschweig, p. 89 (Central Russia).

143 1850. L. t[imidus] var. hyemalis Tumac, Eversman, E., Estestvennaya istoriya Orenburgskogo kraya (Natural History of the Orenburg Territory), part II, Kazan, p. 201.

1851. Lepus medius Middendorf A. Th., Ueber die als Bastarde Angesproch. Mittelformen zu. L. europaeus und L. variabilis, Bull. phys.-mathem., IX, No. 14, S. 13-25 (= aquilonius Blasius).

1851. Lepus aquilonius Simashko Yu., Russkaya Fauna. Mlekopitayushchie (Russian Fauna. Mammals) II, pp. 782-785, pl. 62, fig. 2.

1871. Lepus timidus β. hyemalis (=hybridus) Bogdanov, M. N., Ptitsy i zveri chernozemnoi polosy Povolzh'ya (Birds and Mammals of the Chernozem Belt of the Volga Region), pp. 175-176.

1889. Lepus timidus var. tumak Tikhomirov A. A. and Korchagin A. N., Spiski i opisanie predmetov, nakhodyashchikhsya v zoologicheskom muzee Moskovskogo universiteta (Catalogue and description of Specimens in the Zoological Museum of Moscow University), Izvestiya Obshchestva lyubitelei estestvoznaniya, LVI (4):31 (named from a hybrid between blue hare and common hare).

1908. Lepus medius aquilonius Hilzheimer M., Die Hasenarten Europas, Jahrh. d. Vereins f. Vaterl. Naturk in Württenb., p. 388.

1910. Lepus medius aquilonius Trouessart E. L., Faune des Mammifères d'Europe. p. 217 (Central Russia).

1912. Lepus europaeus hybridus Miller G. S., Catalogue of the Mammals of Western Europe, pp. 508-509.

1913. Lepus (Eulagos) europaeus aquilonius Ognev S. I., Mlekopitayushchie Moskovskoi gubernii (Mammals of the Moscow Province), pp. 283-298.

1929. Lepus (Eulagos) europaeus hybridus Ognev S. I., Zur Systematik der russischen Hasen, Zoologischer Anzeiger, Bd. 84, H. 1/4 p. 74.

TYPE LOCALITY AND POSITION. Former Moscow Province (for details, see systematic notes). Type lost.

MATERIAL EXAMINED. 46 pelts and 61 skulls.

DIAGNOSIS. Fur on back wavy, in summer rich clay-rust-yellow without a dull earth-gray tinge and blackness.

The color of winter fur differs sharply from that of summer fur because of the marked gray and whitish tones.

Length of skull usually more than 100 mm; length of hind feet more than 150 mm (usually 160-170 mm).

ADDITIONAL DESCRIPTION. Weight of *L. e. hybridus* about 4-4.5 kg. G.I. Polyakov reported that the heaviest of 40 common hares killed in the former Bogorodsk County of the Moscow Province weighed 5.2 kg. Larger weights are very rare.

G.I. Polyakov sent me a document signed by three people who testified that A.A. Kustarev killed a female hare (not pregnant) on December 24, 1915 in the former Pokrov County of the Vladimir Province which weighed 10.2 kg. Such specimens are of course exceptional.

A detailed description of summer and winter fur of adult *L. e. hybridus* has been given above.

The general color of the fur of head and back of very young hares about half the size of adults is straw-yellow-sandy speckled chestnut-brown. This color is caused by isolated hairs of the underfur. Basal parts of underfur dull gray (hair-brown, Ridgway, 1912); their apical parts more straw colored (drab). Color of guard hair as follows: base brown-gray; middle part blackish brown; subapical part pale, straw-sandy; apex
144 blackish brown.

A broad, pale straw-gray stripe across the chest. Legs of the same color.

There is often a white spot on a straw-brown background on the forehead.

Young *L. europaeus hybridus* of this age are of a lighter and duller color than young *L. e. tesquorum*.

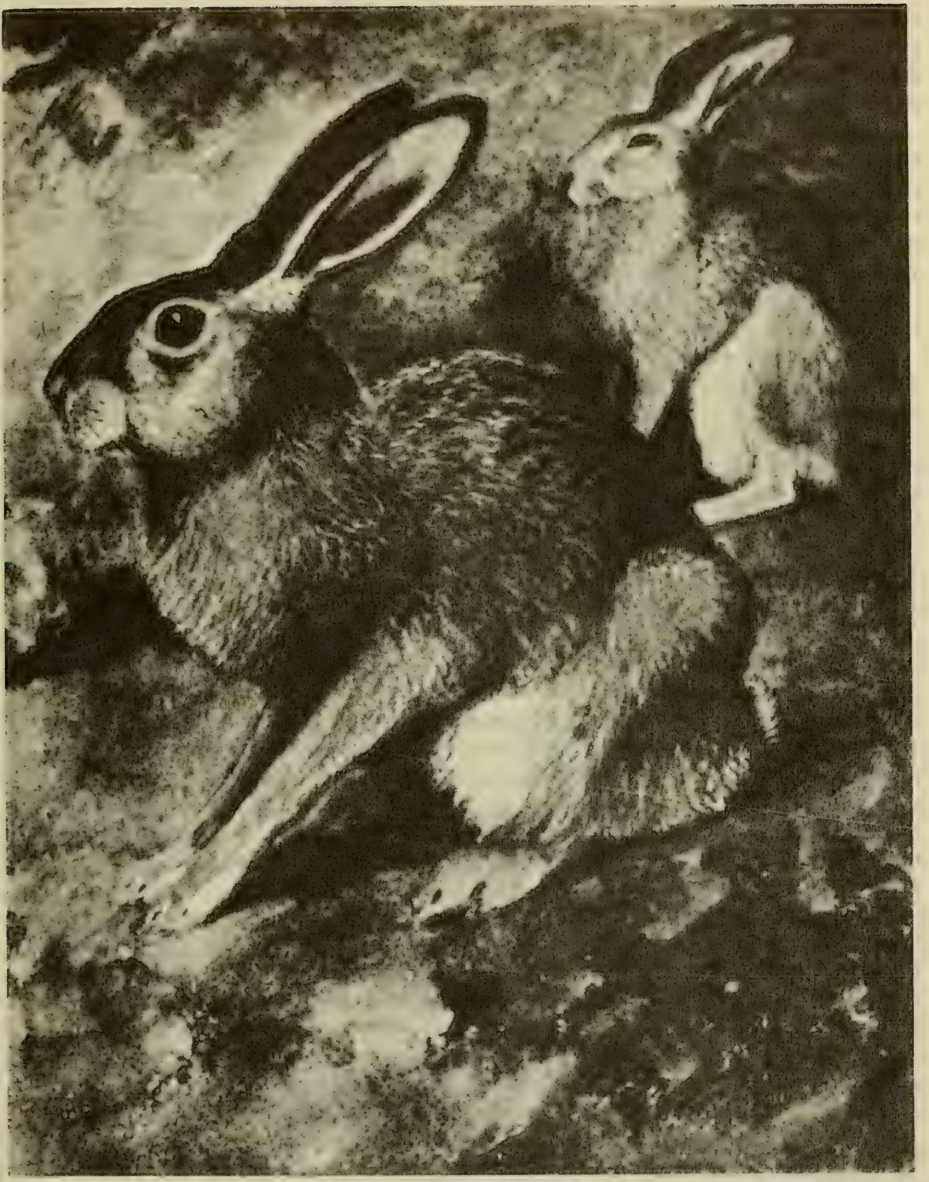
The color of young *L. e. hybridus* (about half the size of adults) differs generally only little from that of very young specimens.

The general color of the fur on head and back varies between shades of yellowish straw-gray with a more or less pronounced sandy tinge. Rust-gray shades on chest and flanks, and on a broad transverse stripe on the chest varying between wood-brown (brownish gray with pinkish straw) to grayer shades than pinkish cinnamon (rust-ocher).

Measurements of *L. europaeus hybridus*: length of skull 99.3-106.5 mm (M. 101.9 mm); condylobasal length 89.1-97 mm (M. 91.9 mm); zygomatic width 46.9-51.2 mm (M. 48.5 mm); length of nasal bones 46.1-49.5 mm (M. 47.5 mm); width of nasals 15.8-21.1 mm (M. 19.2 mm); length of bony palate 5.3-8.1 mm (M. 6.6 mm); width of incisive foramina 11-13.5 mm (M. 11.8 mm); length of upper tooth row 17.1-20.2 mm (M. 18.6 mm); hind feet 164-175 mm; ear including terminal hair (measured from forehead) 110-129 mm.

SYSTEMATIC NOTES. Pallas (1811) noted the variety *Lepus variabilis var. hybrida*. He gave the following description: " "Hyeme non plane alba, quam Rossi sequentis nomine Russak apellere solent". He does not give the range of "var. *hybrida*".

M.A. Desmarest (1820) in "Mammalogie ou description des espèces des Mammifères", mentions "*Lepus hybridus* Pall., russak des Russes". He gives the following range for it: "Habite certains cantons de la Sibérie et de la Russie".



Central Russian common hare (Lepus europaeus hybridus Desm.) (foreground). Steppe common hare (Lepus e. tesquorum Ogn.) (background)

I. Blasius (1842) mentions a hare from central Russia under the name Lepus aquilonius.

Blasius (1857) in "Naturgeschichte der Säugethiere Deutschlands", p.412, 417 makes L. aquilonius a synonym of L. timidus (=europaeus). On later pages Blasius separates a "northeastern form" (nordöstliche Form), to which he ascribes L. caspicus, L. aquilonius, L. medius and L. variabilis var. hybridus.

E. Eversmann (1850) mentioned the variety: hyemalis Tumac, with the following description: "Albicans, vultu, mediodorso, colli lateribus paginaque antica antipedum griseorufis". He writes in "Natural History of the Orenburg Territory" (Estestvennaya istoriya Orenburgskogo kraya) p. 204, "This race of the common hare named by Tumac turns white in winter." Later, Professor Eversmann suggests doubtfully that the Tumac hare (var. hyemalis) may be a hybrid between the common and the blue hare.

The central Russian common hare described by us was described without a doubt by Academician Middendorf (1851) under the name Lepus medius.

G.S. Miller (1912) mentions this form under the name Lepus europaeus hybridus Desmarest, and considers central Russia as its terra typica. The range of this form should be defined more accurately, 145 in my opinion, and the former Moscow Province should be considered as the type locality of L.e. hybridus (see S. Ognev, Zoologischer Anzeiger, 1929, S. 74).

I have discussed the so-called Tumac hare in sufficient detail ("Mammals of the Moscow Province" (Mlekopitayushchie Moskovskoi gubernii) 1913, p.294-295). There is confusion in the old hunting literature about the identity of the Tumac hare. Some zoologists also confused the Tumac hare (a hybrid) with the central Russian common hare (a subspecies). The winter fur of the latter becomes much lighter than the clay-yellowish brown summer fur of the Tumac hare. M.N. Bogdanov (1871) named the Tumac hare "steppe common hare", but did not give its exact range and gave only a short, inexact diagnosis. Bogdanov also gave the Tumac hare (or, according to him, the steppe common hare) a special name, Lepus campestris Bogd.

Pallas (Zoographia Rosso-Asiatica, 1811, p. 147) mentions, in his description of the blue hare, that: "varietas forte hybrida, hyeme non plane alba, quam Rossi sequentis nomine (Russak) apellere solent...". He doubts whether this variety should be considered as a hybrid between two species.

According to the hunting literature, the Tumac hare (hybrid) is more agile and runs faster than the blue and common hares.

It seems quite clear that there are 3 separate forms: 1) a race of the common hare L.e. hybridus, the winter fur of which is much lighter*; 2) a steppe form called Tumac hare by M.N. Bogdanov; 3) hybrid between the common and blue hare, which is correctly called Tumac hare (this name is thus used only for the hybrid form).

I already pointed out in the past that the characteristic features of the blue hare usually predominate over those of the common hare in the Tumac hare. But there appear new specific characters as well, such as the rust color of the base of winter hair, which do not occur in the common and blue hares. The structure of the skull of the Tumac hare is in many respects intermediate between that of the two parents. This was pointeed out by E. Lönnberg (Proceed. Zool. Soc. London 1905, pp. 278-287). Skull No. S.2399 (collection of the Moscow Zoological Museum) from the former Saratov Province is very similar to the skull of the blue hare. However, it resembles that of the common hare in the following characters: 1) premaxillary more slanting and longer than in the blue hare; 2) first lower molar inclined backwards. Orbit delimited by the thick zygomatic bone which is elevated posteriorly at a considerable angle and generally resembles that of the blue hare.

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* The Turgai common hare L. e. caspius natio turgaicus Ognev, the description of which follows below, becomes even more white in winter.

Specimens of the central Russian common hare, which are very closely related to L. e. tesquorum (see below) occasionally occur among typical L. e. hybridus. Such is, for instance, specimen No. S.4976
146 (collection of the Moscow Zoological Museum) obtained near the Kudinovo Station (near Moscow) by E.P. Spangenberg on September 22, 1922. The hair of this specimen lacks the characteristic waviness of hybridus, and its color is duller, more earth-colored than that of typical central Russian hares.

There are two pelts in the collection of the Moscow Zoological Museum obtained by S.A. Buturlin near Wesenberg [Rakvere] Estonia (former Estland). The color of these pelts is very peculiar.

General color of the back intense clay-rust-red (intermediate between tawny and orange-cinnamon, Ridgway, 1912). Flanks, and especially chest, with a very prominent reddish brown tinge. General color of chest intermediate between orange-cinnamon and cinnamon. Anterior sides of forelegs very richly colored.

The specimens from Wesenberg are also characterized as follows: 1) underfur pure white; 2) middle part of hair broadly black; 3) apical part of hair deeply colored, causing the typical reddish clay tinge. The subapical part of the hairs of the back appears intermediate between pinkish cinnamon and ochraceous buff under a magnifying glass. The dark color of the fur is caused by black hair tips and long guard hair with black apical part and without clay-yellowish rust subapical part.

Specimen No. S.3998 in the collection of the Moscow Zoological Museum has no date of capture. It was probably caught in fall before the onset of the molt, according to its fur.

The second specimen (No. S.4980) was caught near Wesenberg in mid-October 1903 (New Style). The lower part of the back is slightly grayer in this specimen, indicating the beginning of molt.

The Wesenberg [Rakvere] hares are systematically closely related to L. e. occidentalis de Winton, described from England (Herefordshire). A series would have to be compared, to solve the question. Hares living along the Baltic Coast are very closely related to, and probably identical with, common hares in Great Britain.

L. e. hybridus is usually considered by furriers to belong to the "central" strain. They also ascribe to this strain hares from the Central Chernozem Area (L. e. tesquorum). L. e. hybridus penetrates the region of the "Menzelinsk Strain" at the eastern boundary of its range. Common hares transitional to the well differentiated eastern race (see below) occur in this region.

The Turgai-Orenburg Steppe is populated by the well differentiated natio L. e. caspicus natio turgaicus Ogn. (see below).

GEOGRAPHICAL DISTRIBUTION. This subspecies is widely distributed in the central part of eastern Europe. Intermediate forms between L. e. europaeus and L. e. hybridus, in which characters of the typical subspecies predominate, occur in the west from the vicinity of Novaya Aleksandriya [Pulawy] (from where I obtained specimens). The same intermediate forms occur in the Kiev District and in Zvenigorodka. L. e. 147 hybridus with more pronounced characters of the race occurs farther east. Hybridus also occurs in northeastern Europe (see below) and in the south (about 53-54°N). Hares from near Novosil are intermediate between hybridus and tesquorum. Most of the hares from Skopin are intermediate between tesquorum and hybridus, with strong resemblance to the latter. Hares from Lipetsk and Kozlov definitely are L. e. tesquorum. Hares caught near Kuznetsk belong to L. e. hybridus but their winter fur is much whiter than that of Moscow specimens.

It is difficult to determine the boundary of the range of L. e. hybridus in the central Trans-Volga region. Hares from Kazan and specimens from the middle reaches of the Belaya river are apparently an intermediate type. They have characters in common with the eastern race L. e. caspicus natio turgaicus, namely the markedly white winter fur. Hares from the following localities are characterized by intensely white winter fur and large size: Vyatka, Kotelnich and Nolinsk districts; Votish Region; Vologda Region. In order to determine to which subspecies they belong, their summer fur should be compared with that of hybridus and their skulls measured. They certainly differ from the central Russian subspecies. This question should be further studied.

329. Lepus (Eulagus) europaeus tesquorum Ogn. (1923). Steppe common hare

1853. Lepus timidus Chernai A., Fauna Khar'kovskoi gubernii (Fauna of the Kharkov Province), p. 14.

1871. L[epus] campestris Bogdanov M. N., Ptitsy i zveri chernozemnoi polosy Povolzh'ya (Birds and Mammals of the Chernozem Belt of the Volga Region), p. 175-176.

1894. Lepus timidus Silant'ev, A. A., Fauna Padov (Fauna of the Pady*), St. Petersburg, p. 79.

1910. Lepus europaeus Ognev S. I. and Gorbachev. S. N., Mlekopitayushchie Yugo-vostoka Orlovskoi gubernii (Mammals of Southeastern Orel Province), p. 28.

1923. Lepus europaeus Zverezomb-Zubovskii E. V., K poznaniyu fauny mlekopitayushchikh Donskoi oblasti (The Mammal Fauna of the Don Region), p. 29.

1923. Lepus europaeus tesquorum Ognev S. I., Fauna nazemnykh pozvonochnykh Voronezhskoi gubernii (Terrestrial Vertebrates of the Voronezh Province), pp. 115-121.

1927. Lepus europaeus tesquorum Migulin, A. A., Obzor gryzunov Ukrainy (Survey of the Ukrainian Rodents), Protection of Plants in Ukraine, No. 3-4, p. 73.

1928. Lepus europaeus Gavrilenko, M., Opyt sistematicheskogo kataloga zverei Poltavshchiny (A Systematic Catalogue of the Mammals of the Poltava Region), p. 13.

TYPE LOCALITY AND DEPOSITION. Type No. M 2986, male, June 17, 1922, Dokuchaev Experimental Station, Bobrov County, Voronezh Province, collected by A. I. Yurin. S. I. Ognev's collection.

MATERIAL EXAMINED: 44 pelts and 60 skulls.

DIAGNOSIS. Fur on back not wavy. Summer fur dull, brown-yellowish gray with an earth shade, often with marked blackness. Chest and lateral parts of inguinal region dull, straw-grayish rust colored. Winter fur markedly whiter and grayer than summer fur. Earthy rust-brown color persisting in winter fur only in middle of back as a round patch, on top of head, on ears and neck. Size large: length of skull in full-grown specimens usually more than 100 mm; length of hind feet 167-185 mm. 148

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* ["Pady" - depressions in the steppes of European Russia.]

Average weight about 6-6.4 kg*.

ADDITIONAL DESCRIPTION. Anterior part of muzzle dull, straw-gray (close to drab, Ridgway, 1912); a strong admixture of blackish hair on the forehead between the eyes, where a dull straw tinge (drab) appears only in spots on a black-gray background.

Eyes surrounded by gray-white ring with a slight straw tinge. Blackish hairs mixed with straw-gray ones on the cheeks under the eyes. Hair on neck anteriorly dull, earth-straw colored (close to drab but with a slight rust tinge). Back earth-gray with a brownish and straw tinge. Hair of back without the typical waviness of northern hares. Basal part of guard hair whitish gray; subapical parts intensely black; distal parts of guard hairs pale straw-gray; tip often blackish. Posterior part of back with a slight gray tinge. Flanks dull, straw-earth-gray (intermediate between drab and wood-brown) with a slight reddish rust tinge. Lower part of throat, chest and sides of inguinal region rust-straw-gray (intermediate between wood-brown and avellaneous). Anterior sides of feet earth-gray with a straw tinge. Inner margins of ears with blackish hair, and with a broad pale straw-earth band on both sides. Insides of ears whitish. A distinct oblong blackish spot on outer side of ears. Posterior parts of ears gray-straw-whitish; tips black.

There are many variations of this typical color either towards an even duller color, or towards richer and more intense colors. However, the color of L. e. tesquorum is never as rich as that of L. e. hybridus.

Winter fur much longer and fluffier than summer fur. The brownish earth color persists in winter fur only as a small rounded patch in the middle of the back. Flanks, lateral and posterior parts of back white, with straw-gray tinge. Whitish gray tones cover the anterior part of the muzzle, cheek, throat and chest. Rust-straw colors persist only weakly on the chest.

The color of young L. e. tesquorum differs sharply from that of L. e. hybridus. Specimens of this subspecies are more easily distinguished when young.

In young hares about 150 mm in length the head and back are very dark, blackish brown with a slight pale straw speckling intermediate between avellaneous and pinkish buff. A straw tinge is more pronounced on flanks. 149 Chest and neck dull brown-gray except the whitish gray chin. Lighter, pale straw colored hair tips are also found in these ares. Belly a dirty whitish gray. Many specimens with a small white spot on forehead. Feet with dark brown hair, pale straw at tips. Tail dorsally blackish brown and white ventrally. Outsides of ears whitish with a straw tinge. Inner margin of ears with dark brown hair with straw tips. Insides of ears whitish straw. Inner margin of inner half of each ear with an elongated blackish brown spot.

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* According to N. V. Kireevskii ("Forty years of Hunting" (40 let postoyannoi okhoty), Moscow, 1875, p. 145) the largest hare of 12,903 common and blue hares killed from 1815-1856 weighed about 20 pounds (i. e., 8 kg). This probably applies to L. e. tesquorum, as N. V. Kireevskii hunted chiefly in the Kursk and Orel provinces.

Color of individual hairs on the back as follows: bases of hair brownish gray; a dark black-brown band in the middle; subapical part narrow, pale straw colored; tip blackish brown. Hair of underfur with brownish gray bases and more brownish tips.

This coloration varies, as the straw color of the hairs is developed to a various extent in different specimens.

In young specimens, half the length of adults, the fur becomes smoother and hair straighter than in the soft, fluffy and slightly wavy fur of the very young. The straw-yellow subapical parts of the hair on the back become better marked and the fur therefore appears lighter. Color of head dark, from grayish black-brown to brownish. White spot on forehead usually well marked.

The white area on the chin becomes broader and better marked, and covers the upper part of the neck. A broad stripe which varies between pale rust-straw to dull rust color (from wood-brown to grayer than cinnamon) is clearly marked across chest and neck. Belly white. Inguinal region with pale straw-rust tones.

Measurements of L. europaeus tesquorum: length of skull 97-108.5 mm (M. 102.8 mm); condylobasal length 87-97.5 mm (M. 92.2 mm); zygomatic width 46-54 mm (M. 49.2 mm); length of nasal bones 43.2-50.9 mm (M. 47.8 mm); breadth of nasals 17.2-23.6 mm (M. 20.1 mm); length of bony palate 5.6-7.9 mm (M. 6.8 mm); breadth of incisive foramina 10-15.2 mm (M. 12.2 mm); length of upper tooth row 16.8-20.7 mm (M. 18.2 mm).

Length of body with head 595-610 mm; hind feet 150-185 mm; ear (measured along concavity) 103-140 mm.

SYSTEMATIC NOTES. Various hunters have written on the differences between the steppe common hare and the common hare of the central forest belt of the European part of the U.S.S.R. M.N. Bogdanov (1871) named the steppe common hare 'Tumac', and wrote: "The Tumac hare (L. campestris nob.) is not a hybrid of the common and blue hare, but a steppe variety of the common hare (L. timidus), differing from it in the following characters: 1) grayer color; 2) short broad body; 3) rapid running. The Tumac hare is rare and sporadically distributed in stony parts of the steppe."

It is, in my opinion, more correct to call the steppe common hare L. e. tesquorum for the following reasons: 1) Bogdanov wrongly named the steppe common hare 'Tumac'; 2) the form has no description, as the incorrect indication of its "gray color" can hardly be called a description; 3) the geographical range of the Tumac is not given.

150 Like all subspecies with transgressive characters, the steppe common hare is clearly distinguished from its northern relations in series. Some specimens of the steppe common hare, especially from places on the border of the range of L. e. hybridus, are almost indistinguishable from L. e. hybridus. One of the clearest and most constant differences, besides color, is the absence of wavy hair on the back, a typical character of L. e. hybridus.

GEOGRAPHICAL DISTRIBUTION. Russian Chernozem steppes. The northern boundary of its range has not yet been defined. This subspecies apparently occurs from Nezhin in the east to Novgorod-Seversk, Trubchevsk, Orel, Novosil, Skopin, Morshansk, and Penza up to the Samara Bend. I have not examined material from the Trans-Volga region.

I cannot, therefore, state definitely which subspecies occurs in the Samara Steppes and on the Obshchii Syrt. L. e. tesquorum probably occurs along the Greater and Lesser Irgiz rivers, to judge from material from near Volsk. L. e. tesquorum possibly also occurs between Bugulma, Buguruslan and Buzuluk, but this region may be inhabited by forms intermediate to the eastern race, which become very white in winter. The Dnieper is the western boundary of the range of this subspecies. A. A. Migulin (1927) was apparently correct in stating that the range of tesquorum includes the forest steppe of the left bank Ukraine [territory east of the Dnieper].

It is difficult to state how far south the range of L. e. tesquorum extends. L. e. transsylvanicus occurs in the southern Dnieper and southern Tauric Steppes, but not in the Crimea. N. F. Nikolaev sent me a specimen from Berdyansk. The large skull of this specimen suggests that it belongs to L. e. tesquorum. However, its summer fur is a lighter color than that of the typical tesquorum. Such a hare was sent to me by V. V. Raevskii from the southern Don Steppes. The range of L. e. tesquorum in the northern Caucasus reaches that of L. e. caucasicus. It is difficult, or impossible, to determine the exact boundary of these subspecies. At any rate, the Kalmyk, Nogai and Kuban hares belong to L. e. caucasicus.

330. Lepus (Eulagus) europaeus transsylvanicus Matchie (1901). Roumanian or Crimean common hare

1889 Lepus timidus var. (=L. mediterraneus) Tikhomirov A. A and Korchagin A N., Spiski i opisanie predmetov, nakhodyashchikhsya v Zoologicheskom muzee Moskovskogo universiteta (Lists and Description of Specimens in the Zoological Museum of the Moscow University), Izvestiya Obshchestva lyubitelei estestvoznaniya, antropologii i etnografii, VI (IV), Mlekopitayushchie, p. 31 (from a specimen from the vicinity of Sevastopol).

1891. Lepus europaeus (Lepus mediterraneus) Nikol'skii A. N., Pozvonochnye zhivotnye Kryma (Vertebrates of the Crimea), appendix to Vol. XVIII, "Zapiski Akademii Nauk", No. 4, pp. 77-80 (the Crimean common hares belong to the "form" mediterraneus in the author's opinion).

1901. Lepus transsylvanicus Matschie P., Rumänische Säugetiere, Sitzb. der Gesellsch. naturf. Freunde z. Berlin, S. 236.

1908. Lepus europaeus transsylvanicus Hilzheimer M., Die Hasenarten Europas, Jahresb. des Vereins für Vaterl. Naturk. in Württemb., S. 394.

151 1912. Lepus europaeus transsylvanicus Miller G. S., Catalogue of Mammals of Western Europe, p. 509.

1916. Lepus (Eulagos) europaeus transsylvanicus Ognev S. I. Mlekopitayushchie Tavricheskoi gubernii (Mammals of the Taurian Province), part I, Gryzuny (Rodents), pp. 55-63.

TYPE LOCALITY AND DEPOSITION. Tasleu, northeastern Roumania. Type in the collection of the Berlin Museum.

MATERIAL EXAMINED: 30 pelts and 32 skulls.

DIAGNOSIS. Fur not curly. Summer fur yellowish brown-gray with an earth-clay tinge, often with a distinct black tinge.

Chest and sides of inguinal region rich clay-red.

Winter fur usually darker than summer fur, with more marked blackness. Gray color very little marked; gray hair found only in lower part of back, and to a small extent on flanks and cheeks.

Size small: length of skull usually less than 100 mm (89.3-101 mm, M. 94.2 mm); length of hind foot 123-160 mm (M. 147 mm). Average weight 3.2 kg (2.9 kg-3.9 kg).

ADDITIONAL DESCRIPTION. Winter fur. Entire forehead and occiput brownish gray, mottled with yellowish straw hair tips. The general color of these parts is therefore relatively light. Color of hair as follows: the well marked bases of the hair earth-gray-brown, followed by well marked black bands; straw-yellow subapical parts; black tips. Upper part of head frequently with small patches of white hair. General color of upper part of muzzle lighter as a result of the greater admixture of yellowish straw hair tips which become white on the ventral side of the muzzle. A diffuse, indistinct whitish stripe of hairs with gray basis and whitish apex from the eye to the tip of the nose. Ring around the eyes whitish with indistinct ocher tinge. A narrow whitish stripe from the eye to the ear. A broad rust-brown stripe ventral to the whitish ring around the eye. Cheeks grayish white with a slight ocher tinge and an admixture of blackish hair. Anterior margin of ears with dense, short hair with marked black bases and straw-yellow tips. Outer margin of anterior edge of ears with long, straw-whitish hair. Inner side of ears densely covered with short straw-whitish hair with a diffuse elongate spot on the outer side. Proximal part of outside of ear with dirty-yellow fur; distal part of outside of ear with a well marked black spot extending 40 mm along the outer edge. The area behind the ears covered with reddish rust-brown fur. Back with dense fur which is generally rather dark earth-straw with a strong black tinge. Color of individual hairs on back as follows: 1) base of guard hair blackish; 2) middle part pale straw-rust colored, sometimes more whitish; 3) tip blackish. Completely black guard hair occurs sometimes among guard hair of the color described. Underfur wavy, whitish. Tips of underfur hairs dull blackish brown.

Many white hairs or white hair with short blackish tips occur on the lower part of the back. The admixture of white hair imparts a general 152 grayish white color to the lower part of the back.

Rust-ocher tones well marked on sides of back, best marked on the shoulders and the inner side of haunches; the same colors form a broad belt across the chest and the lower part of the neck. The long hair in this region has a dull rust-red-ocher tinge (intermediate between wood-brown and cinnamon). White hairs also occur in these parts.

Isolated very long hairs with black base and a broad white tip on the sides. Anterior sides of forelegs with light ocher-straw-earth colored fur. Soles of hind legs whitish, mixed with pale ocher hair. Tail white, blackish brown or black dorsally.

Color of summer fur more rust-colored, lacking black tone typical for the winter fur. Top of head with marked rust-straw tones. Gray tones absent on cheeks and lower part of back. Color of flanks, a transverse stripe on the chest, and legs more saturated clay-rust colored than in winter.

Color of young Crimean hares relatively light, similar to that of Moscow hares though perhaps a little lighter, sharply different from the color of young L. e. tesquorum.

Measurements of Lepus europaeus transsylvanicus. Length of skull 89.3-101 mm (M. 94.9 mm); condylobasal length 78.2-89 mm (M. 83.6 mm); zygomatic width 43.2-48.2 mm (M. 46.1 mm); length of nasals 37.2-46.5 mm (M. 43.1 mm); width of nasals 16.8-21.1 mm (M. 18.6 mm); length of bony palate 5-7.8 mm (M. 6.2 mm); width of incisive foramina 9.6-13.3 mm (M. 11.1 mm); length of upper tooth row 15.3-18.1 mm (M. 16.9 mm).

Length of body and head 550-600 mm (M. 564 mm); hind feet 124-160 mm (M. 147 mm); ear (measured along concavity) 102-118 mm (M. 107.2 mm).

SYSTEMATIC NOTES. The Crimean common hare resembles L. e. tesquorum externally, but differs from it in the following characters: 1) smaller size and weight; 2) richer clay-rust color of chest and flanks in summer fur; 3) winter fur darker, with black hair more developed than in the summer fur, not lighter, more whitish or grayish as in tesquorum.

The Crimean hares of my collection are identical with an Albanian specimen sent to me by the British Museum identified as Lepus transsylvanicus.

According to the classification of furriers, the Crimean common hares belong partly to the southeastern strain of the common hare.

GEOGRAPHICAL DISTRIBUTION. Throughout the Balkans, in Roumania, Bessarabia (at least in its southern part), between Dubossary, Olgopol
153 and Nikopol, and in the southern Tauric Steppes in Crimea. More eastward, near Osipenko, [former Berdyansk], occur hares closely resembling tesquorum in their skull measurements. These specimens are apparently of an intermediate type, and they resemble hares from the southern Don Steppes (see above).

331. Lepus (Eulagus) europaeus caucasicus Ognev (1929). Caucasian common hare

1887. Lepus timidus Rossikov K. N., Obzor mlekopitayushchikh doliny reki Malki (Survey of the Mammals of the Malka River Valley), pp. 74-75.

1924. Lepus europaeus transsylvanicus Ognev S. I., Gryzuny Severnogo Kavkaza (Rodents of the Northern Caucasus), pp. 7, 8.

1925. Lepus europaeus transsylvanicus Beme L, Rezul'taty ornitologicheskoi ekspeditsii v Kizlyarskom okruge Dagestana (Results of an Ornithological Expedition to the Kizlyar District (Dagestan)), p. 24.

1926. Lepus europaeus transsylvanicus Radishchev A. M., Materialy k poznaniyu fauny gryzunov Kabardino-Balkarskoi Avtonomnoi oblasti (Data on the Rodent Fauna of the Kabardino-Balkarian Autonomous Region), "Izvestiya Severokavkazskoi kraevoi stantsii zashchity rastenii", No. 2, p. 84.

1926. Lepus europaeus transsylvanicus Turov S. S., Opyt systematicheskogo obzora mlekopitayushchikh Osetii (A Systematic Survey of the Mammals of Ossetia), Uchenye zapiski Severokavkazvskogo instituta kraevedeniya, I. p. 321.

1929. Lepus europaeus caucasicus Ognev S. I., Zur Systematik der russischen Hasen, Zoologisch. Anzeiger, Bd. 84, H. 1/4, S. 75.

TYPE LOCALITY AND DEPOSITION. M. 2973 female, 30 November, 1923, vicinity of Vladikavkaz [Ordzhonikidze]. Type in S. I. Ognev's collection

MATERIAL EXAMINED: 38 pelts and 47 skulls.

DIAGNOSIS. Fur on back not wavy. Summer fur of most specimens rather dull, brownish yellow-gray with an earth tinge. Summer fur often with slight black tinge, sometimes more clay-yellow with an earthy tinge.

Clay-red tones on chest and flanks little marked in specimens found in summer, replaced by stronger yellow-clay-gray tones.

Color of winter fur almost like that of summer fur, not darker as in L. e. transylvanicus. Only the lower part of back has a gray color. A light gray tinge also on the flanks. Whitish gray colors on cheeks and sides of muzzle.

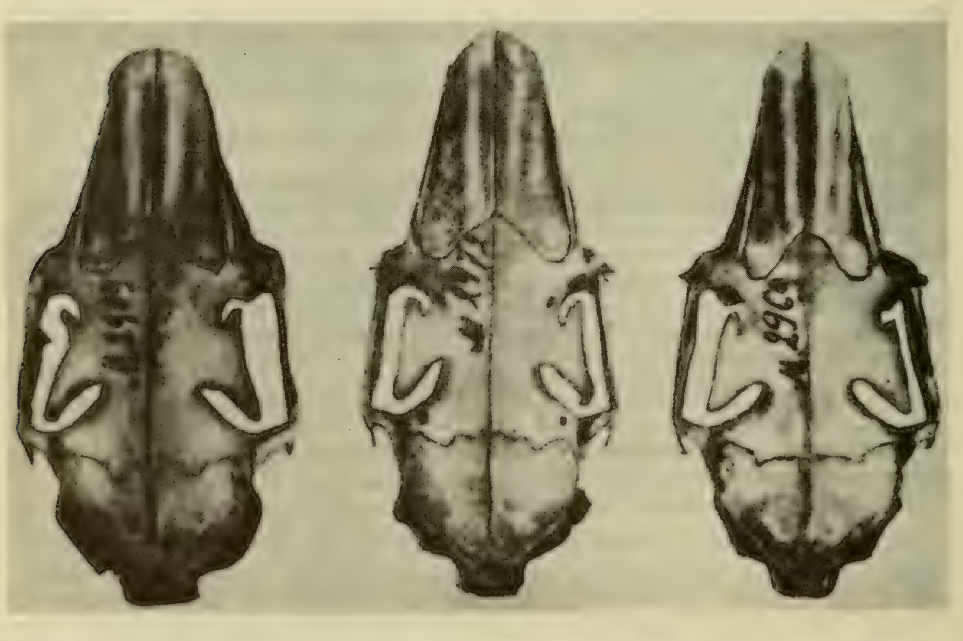
Measurements larger than in L. e. transsylvanicus. Length of skull about 100 mm (92-105 mm; M. 99.2 mm); length of hind feet 140-167 mm (M. 151.4 mm). Average weight 4 kg (3.2-4.4 kg).

SYSTEMATIC NOTES AND ADDITIONAL DESCRIPTION. The color of North Caucasian hares varies little. General tone of summer fur earth-colored, only slightly different from that of L. e. tesquorum in its richer color and stronger ocher tone on chest and anterior sides of forefeet. Color of summer fur intermediate between that of the Crimean subspecies and of L. e. tesquorum.

Specimens with light clay tones and a slight sandy tinge occur together with specimens of ordinary color. Specimen No. M. 2946 in my collection (14 October 1923, near Vladikavkaz [Ordzhonikidze]) may be considered as representative of this clay-colored form. This specimen was caught at the beginning of the molt.

154 As mentioned above, the winter fur of L. e. caucasicus is generally almost indistinguishable from the summer fur. The winter fur of Caucasian hares is lighter than that of Crimean hares, in which it shows a marked blackness on the back.

During examination of the collection of the Caucasian Museum, my attention was drawn to specimens from the Bogos Range. The color of their winter fur is transitional to that of L. e. cyrensis. Specimen No. 2-09, 1907 resembles this subspecies particularly closely.



FIGURES 79-81. Variation of nasals in Lepus europaeus caucasicus Ogn. 79 — Specimen from Dagestan, near Karabudakhkent, No. M. 2959, S. I. Ognev's collection. 80 — Specimen from the same locality, caught in 1923. No. M. 2972, S. I. Ognev's collection. 81 — Specimen from the same locality, 1923. No. M. 2969, S. I. Ognev's collection

Photograph by S. I. Ognev

Hares from the Kizlyar Valley and from Kara-Nogai Steppes are much lighter in color than L. e. caucasicus. They are transitional to L. e. caspicus.

There are specimens among the Kizlyar hares which are indistinguishable from L. e. caucasicus from the mountains. The old specimen No. M. 2966, caught on 4 June 1923 near Malaya Areshovka, in the Kizlyar District belongs to this group. Its color closely resembles that of a hare shot in the xerophytic mountain steppes of Dagestan (near the village of Karabudakhkent).

Color of summer fur of specimens from the Caucasian Coast of the Black Sea (near Beta) differs from that of specimens from the Central Caucasian Range in the stronger development of clay tones, especially on chest and 155 flanks. The color of the winter fur on specimens from Batum and Sukhumi differs markedly from that of typical L. e. caucasicus in the more brownish clay tones on the back, the brownish rust-clay transverse stripe on the chest, and the similar color of the flanks.

The winter fur of hares from the Black Sea Coast differs clearly from that of L. e. caucasicus, but the summer fur of both is similar. We observed the same relationship between L. e. caucasicus and L. e. cyrensis.

I classified this Black Sea hare as a separate natio, L. e. caucasicus natio ponticus Ogn. (type No. 4915 female, 29 July 1928, Beta Village, Caucasian Black Sea Coast, B. V. Obraztsov, collection of the Moscow State Zoological Museum) (Zoologischer Anzeiger, Bd. 84, S. 75).

Measurements of Lepus europaeus caucasicus: Length of skull 92-105 mm (M. 99.2); condylobasal length 83-94.2 mm (M. 88.2 mm); zygomatic width 43.6-49.2 mm (M. 46.6 mm); length of nasals 41.1-48.8 mm (M. 45.7 mm); width of nasals 16.3-22.2 mm (M. 19.4 mm); length of bony palate 5-7.7 mm (M. 6.2 mm); width of incisive foramina 10-12.6 mm (M. 11.3 mm); length of upper tooth row 15.2-18.9 mm (M. 16.9 mm).

Length of body with head 560-680 mm; hind feet 140-167 mm (M. 151.4 mm); ear (measured along concavity) 104-115 mm (M. 108 mm).

GEOGRAPHICAL DISTRIBUTION. This subspecies occurs on the Greater Caucasus and in the adjacent northern areas. The northern boundary of the range is not exactly known. It probably runs from the eastern coast of the Sea of Azov through Stavropol - Mozdok - Makhachkala (Port Petrovsk). The southern boundary is also yet to be determined. It runs approximately along 42° N. Specimens intermediate between L. e. caucasicus and L. e. cyrensis (see above) occur in Dagestan on the Bogos Range. In the Central Caucasus, the boundary between the ranges of these two forms passes along the Dushet-Kutaisi line. It is not known how far south along the Black Sea Coast the range of L. e. caucasicus extends. Natio ponticus of this subspecies occurs south of Batum. As to the northern range of L. e. caucasicus, hares from the Kizlyar Valley are to some extent intermediate between L. e. caspicus and L. e. caucasicus.

332. Lepus (Eulagus) europaeus cyrensis Satun. (1905). Transcaucasian common hare

1832. Lepus timidus Ménétries E., Catalogue Raisonné des Objets de Zoologie, p. 23 (partim!).

1876. Lepus caspicus Blanford W. T., Eastern Persia, II, Zoology, pp. 82-83 (Teheran - Isfahan).

1896. Lepus europaeus var. Satunin K., Vorläufige Mitteilungen über die Säugethierfauna der Kaukasusländer, Zoolog. Jahrbücher, Bd. 9, S. 308.

1903. Lepus sp. Satunin K. A., Obzor issledovaniya mlekopitayushchikh Kavkazskogo kraya (A Study of the Mammals of the Caucasus), Zapadno-Kavkazskoe otdelenie Geograficheskogo obshchestva, XXIV, p. 61.

1905. Lepus cyrensis Satunin K. A., Novye i maloizvestnye mlekopitayushchie Kavkaza i Zakaspiiskoi oblasti (New and Little Known Mammals of the Caucasus and the Transcaspian Region), Izvestiya Kavkazskogo muzeya, II, pp. 60-63.

1913. Lepus cyrensis Satunin, K. A., Fauna Chernomorskogo poberezh'ya (Fauna of the Black Sea Coast), p. 41.

156 1918. Lepus cyrensis Kollmann M., Note sur les mammifères rapportés d'Asie Mineure par M. Gadeau de Kerville, Bull. Mus., Paris, pp. 201-204. (Asian Minor).

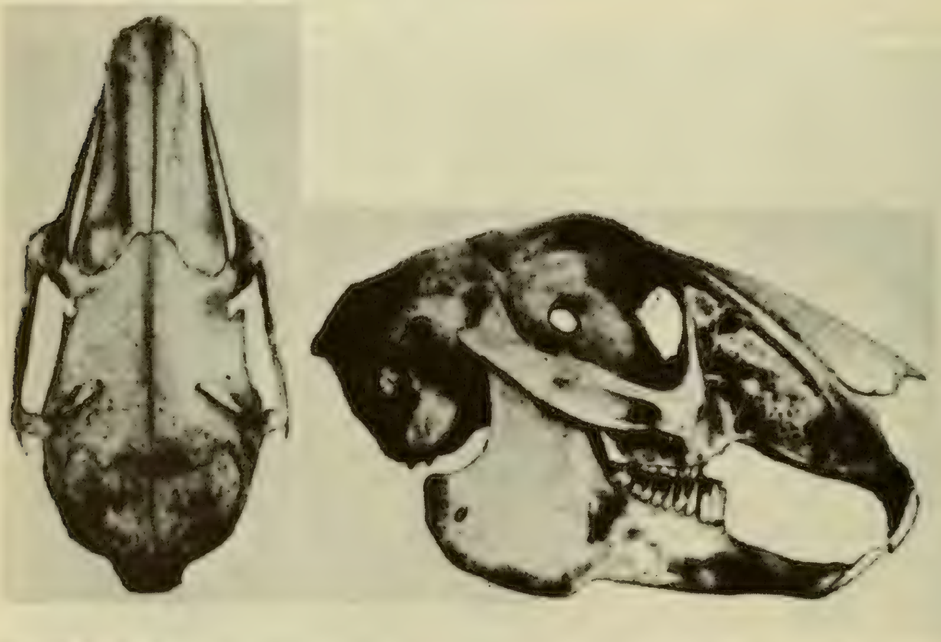
1929. Lepus europaeus cyrensis Ognev S. I., Zur Systematik der russischen Hasen, Zoologisch. Anzeiger, Bd. 84, H. 1/4, S. 76.

TYPE LOCALITY AND DEPOSITION. No. 129 1/k male, December 1904*, post office of the Barda Dzhevanishir County of the Elisavetpol [Kirovabad] Province. Deposited in the Georgian Museum (former Caucasian Museum).

MATERIAL EXAMINED: 54 skulls and pelts.

DIAGNOSIS. Fur straight, neither wavy nor curly. Color of summer fur rather dull, yellowish brown-gray with an earth tinge.

Color of chest and flanks dull, brownish straw (intermediate between avellaneous and pinkish cinnamon), usually without rust tones. Winter fur differs clearly from summer fur in its general paleness and straw-rust-gray tones with a typical vinaceous tinge (vinaceous-buff and avellaneous). Slight gray tones on flanks, lower part of back near tail, and on cheeks.



FIGURES 82, 83. Transcaucasian common hare, Lepus europaeus cyrensis Satun. According to type No. 129 1 Jan. female. Barda, Dzhevanshir County, collection of the Georgian Museum

Photograph by S. I. Ognev

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* The date September 1905 is given in K. A. Satunin's work (loc. cit., 1905). The number of the specimen "129, k" is the same.

Length of skull usually less than 100 mm (91-103 mm; M. 96.6 mm); length of hind feet 144-150 mm.

ADDITIONAL DESCRIPTION. Color of summer fur of L. e. cyrensis very similar to that of L. e. caucasicus. Ground color of back of Transcaucasian common hare slightly lighter. Color of flanks and transverse stripe of chest duller than in L. e. caucasicus in most specimens of L. e. cyrensis. This difference is clearly seen in series. However, there are specimens of L. e. cyrensis in which the color is practically identical with that of L. e. caucasicus.

157 Winter fur of L. e. cyrensis much paler than that of caucasicus. Pale, straw-rust-gray tone with a typical vinaceous tinge, close to vinaceous-buff and avellaneous, intermediate between avellaneous and pinkish cinnamon, predominates in its color. Color of transverse stripe on chest dull straw-brown.

Anterior sides of forelegs and flanks of Transcaucasian hare paler than those of caucasicus, without the rust tinge of the latter. Anterior side of feet especially dull, being whitish straw-gray with a very slight, hardly perceptible rust tinge.

Thus, the top of the head of L. e. cyrensis in winter fur is lighter, paler and grayer than in caucasicus. Cheeks paler, pale straw-gray with a vinaceous tinge (intermediate between vinaceous and light pinkish cinnamon).

Color of young specimens pale yellowish straw-sand colored with earth-rust-brown mottling. Color of transverse stripe on chest and of flanks yellowish straw-gray. General color of fur of young cyrensis similar to that of young L. e. hybridus and L. e. transsylvanicus.

SYSTEMATIC NOTES. The Transcaucasian common hare is very closely related to L. e. caucasicus. It differs from it in its smaller size, paler color of winter fur, and some variable color characters of the summer fur.

An excellent series obtained in winter 1932 (collected by Yu. A. Isakov) in the vicinity of Kalinovka, 35 km south of Lenkoran, is kept in the Moscow State Zoological Museum. The small Lenkoran hares are identical in their skull structure with L. e. cyrensis Satun. (specimens from Yerevan*).

Length of skull of Lenkoran hares varies between 93-97 mm; condylobasal length 81-86 mm; zygomatic width 43.5-48 mm; length of nasals 41-47 mm; width of skull at level of auditory meatus 34.2-36.3 mm; length of row of upper molars 15.3-17.2 mm.

Measurements of body small, generally like those of L. e. cyrensis: length of body with head 490-563 mm; hind feet 130-150 mm; ear 110-115 mm. Weight 2.5-3.3 kg.

The color of winter fur differs sharply from that of specimens caught near Yerevan and along the Kura river. Lenkoran hares are much darker because of the very strong development of black hair tips on the back. The dark color on the back forms a wavy, black pattern varied by the clay-yellow tone of the subapical parts of the hairs. In addition to hair with black tips, the color of the winter fur on the back is greatly influenced by a large number of black guard hairs. The lower part of the back almost never becomes gray in winter fur. Top of head with a marked black tinge, speckled with a lighter yellowish clay tone. Anterior and lateral parts of muzzle with a grayish tinge. A marked rust-brown spot under the eye. Cheeks rust-gray. Anterior margins of inner side of ears with a marked 158 blackish gray tinge. Edges of anterior parts of inner side of ears whitish yellow. Inner sides of ears whitish gray with an admixture of blackish brown hair along the margins, forming a broad, long marginal patch with a yellowish edge. Outer parts of ears whitish gray. Tips of ears with black fringes especially well marked on posterior side of ears. Flanks with a strong reddish rust tinge. An intense reddish rust (pinkish cinnamon) transverse stripe on the chest strongly darkened by black-gray hair tips in many specimens. In specimen No. S.7120 (female), 29 January 1932, Kizyl-Agach (35 km south of Lenkoran, Yu.A. Isakov), the color of the the entire belly is reddish rust-white (light vinaceous-cinnamon). Belly pure white in all others.

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* The skulls of the Lenkoran hares in this series are smaller than those of the Yerevan hares, and the rostra and nasals are narrower.

The Lenkoran hare can certainly be considered as a separate natio. We designate specimen No. S.7119, female, 24 January 1932, of Kizyl-Agach, 35 km south of Lenkoran, as holotype for L. e. cyrensis natio lencoranicus nova. We also examined 18 paratypes.

Not all specimens of the Lenkoran series are identical. The color of most is dark, but some of them are transitional to the lighter form L. e. cyrensis which occur farther northwest. The specimen obtained by A.N. Karamzin on 20 November 1903, 20 km north of Dzhevat is intermediate between the Yerevan and Lenkoran hares.

The collection of the Moscow State Zoological Museum includes a stuffed hare caught in winter in the Mugan Steppe. The light color of this specimen is identical with that of the Yerevan specimens.

It would be very interesting to establish, from adequate material, the type of color of hares in northwestern Iran. We have no material from this interesting region at present.

GEOGRAPHICAL DISTRIBUTION. Caucasia, south of 42°N Asia Minor, northwest Iran (Teheran, perhaps Isfahan).

333. Lepus (Eulagus) europaeus caspicus Ehrenberg (1830). Caspian common hare

1830. Lepus caspicus Ehrenberg Chr. G., Symbolae Physicae seu icones et descriptiones Mammalium. Decas secunda (without pagination).

1875. Lepus caspicus Karelin G.S., Razbor stat'i Ryabinina i. t. d. (A Critique of Ryabinin's Article, etc.), Trudy Sankt-Peterburgskogo obshchestva estestvoispytatelei, p. 78.

1908. Lepus medius caspicus Hilzheimer M., Die Hasenarten Europas, Jahresber. d. Vereins für Vaterl. Naturk. in Württemb., S. 388, Taf. V, Fig. 4.

1910. Lepus medius caspicus Trouessart E.L., Faune des Mammifères d'Europe, p. 217.

1916. Lepus europaeus caspicus Ognev S.I., Mlekopitayushchie Tavricheskoi gubernii (Mammals of the Taurian Province), part I, Gryzuny (Rodents), pp. 58-59, pl. IV, p. 1.

1927. Lepus europaeus caspicus Orlov E.I. and B.K. Fenyuk, Materialy k poznaniyu fauny nazemnykh pozvonochnykh primorskoi polosy Kalmytskoi oblasti (Material on the Fauna of Land Vertebrates of the Maritime Belt of the Kalmyk Region), p. 83.

1928. Lepus europaeus Kuznetsov, B.A., Zametki po faune mlekopityushchikh Ural'skoi gubernii (Notes on the Mammalian Fauna of the Uralsk Province), Trudy po lesnomu opytnomu delu, Tsentral'naya lesnaya opytnaya stantsiya, issue I, pp. 58-59.

1929. L[epus] e[uropaeus] caspicus Ognev S.I., Zur Systematik der russischen Hasen, Zoolog. Anzeiger, Bd. 84, S. 76-77.

159 TYPE LOCALITY AND DEPOSITION. Vicinity of Astrakhan. Holotype apparently lost.
MATERIAL EXAMINED: 30 pelts and 33 skulls.

DIAGNOSIS. Fur on back neither wavy nor curly but straight.

Summer fur very light, rust-clay colored with a sandy-yellow tinge.

Clay-yellow tones on chest and flanks well pronounced in summer fur. The same tones, duller with pinkish and white tinges in winter fur.

The winter fur differs little from the summer fur in specimens from the southern parts of the range of the Caspian common hare. In specimens from the northern border of the range, the winter fur is lighter and whiter.

In specimens of caspicus from Astrakhan, the winter fur is duller but occasionally even more intensely colored than the summer fur, with a less marked rust tinge.

As already stated, the winter fur of specimens from the southern parts of the range is only slightly grayer than the summer fur and this grayer color appears only in the lower part the back. The fur does not become whiter in Astrakhan specimens.

Length of skull 95.3-103.1 mm (M. 100 mm); length of hind feet 137-153 mm (M. 152.2 mm). Weight 3.2-4 kg.

ADDITIONAL DESCRIPTION. Winter fur. Entire forehead and occiput of Caspian common hare clay-yellow. Color of individual hairs from these parts as follows: 1) base of hair with broad gray-earth-yellow band; 2) a narrow black medial band; 3) broad straw-yellow tip. A well-marked black apex in some hairs. A few completely black hairs among the hairs described above. Color of anterior-dorsal part of muzzle much richer and more yellow. A broad straw-white stripe from the anterior margin of the eye to the nose. Ring around the eye whitish ocher. A stripe of whitish hair from the eye to the ear. Cheeks light, clay-yellow, sometimes with a marked whitish tinge.

Anterior margin of ears with short hair which has marked black roots and clay-yellow tips. Upper fringe of anterior margin with longer, yellow-white fur. Inner side with dense clay-white hair, with an indistinct dark spot on the side. Outer side with whitish fur. Only the proximal part of the outer side with a clay tone. Tip of ear with a black fringe about 35 mm long.

The whole area behind the ears, neck and occiput with a reddish pink dull fur, generally of fawn color. Fur on back dense, even, generally of light yellowish clay color. Posterior part of back with many whitish gray hairs. Flanks with rich yellowish clay-red fur (cinnamon) which is strongly marked on the haunches, shoulders and on the transverse white stripe of the chest. Anterior and posterior sides of forelegs with rich yellow-clay-colored hair. Hind legs with light yellowish straw fur.
160 Chin, upper part of throat, all underparts (except the chest), belly and groin with long white fur.

Summer fur, except for the underfur, of a rich rust-clay tone with a general pinkish cinnamon tinge on neck, flanks and chest (Ridgway, pl. XXIX).

Color of head and cheeks with marked rust-clay tones. Summer fur of Caspian hares generally not darker, often lighter and rustier than winter fur.

Young Caspian hares have a duller and paler yellowish gray-rust color. Neck with duller, vinaceous-yellow-rust tones (related to avellaneous, Ridgway, 1912). Flanks more rust-colored, intermediate between avellaneous and pinkish cinnamon.

SYSTEMATIC NOTES. The Caspian common hare is a distinct geographical form. Its color is generally pale, in adaptation to its habitat, the semidesert.

In the northern outskirts of its range, for instance in the vicinity of Uralsk and Temir, the hare becomes markedly lighter towards winter, and transitional to the more northern and eastern natio turgaicus.

Specimens from the Kalmyk steppes differ in some characters from the type. The summer fur of Kalmyk common hares is not so pure ocher-clay-yellow. It is mixed with gray tones in many specimens, sometimes also with more intense brownish clay tones. Flanks and the stripe across the chest in Kalmyk hares have a more intense clay-rust color (cinnamon).

The clay-yellow color of the winter fur of Kalmyk hares is less intense; the flanks and the stripe across the chest are darker, rust-red clay; the color of the stripe on the chest is intermediate between wood-brown and cinnamon.

I described this color variation under the name Lepus europaeus caspicus natio kalmykorum ("Zoologischer Anzeiger", 1929, Bd. 84, S. 77). The type locality is Ikitsokhura, Akima sands, Kalmyk Region, (E.I. Orlov). We also examined 10 paratypes from the type locality.

Hares from the Kizlyar valley are closely related to L. e. c. natio kalmykorum, but paler. Kizlyar hares are lighter than L. e. caucasicus in series. They are intermediate between the Caucasian and Kalmyk hares. They are closer to the Caucasian form, but not identical with it. It is difficult to name this form, and I therefore only give its typical characters.

Hares in the Turgai-Orenburg steppe are a well characterized natio of the Caspian common hare.

Their summer fur is yellow, not rust-clay-yellow, on flanks and chest. The winter fur becomes almost completely white. Hairs with blackish gray roots, pale rust middle parts, and white tips are present only in the middle of the back in a small, oval spot which is made indistinct by the
161 white tips of the guard hairs. The feet become completely white. A rust-ocher shade persists weakly only on the anterior side of the forelegs, and also at the roots of hairs on the flanks and chest. The white hairtips on the chest are so intensely developed that they give a general white color to this area. The transverse rust stripe on the chest disappears completely. Hind feet completely white. A rust-yellow tinge is retained on the top of the head and on the ears, especially on their inner margins.

The Turgai common hare constitutes a well differentiated natio, L. e. caspicus natio turgaicus nova. I designate the specimen caught by A.M. Korsakov on 15 October 1934 in the Sypsyn Forest (Naurzum Reserve), south of Kustanai, as holotype. We examined 5 specimens.

It would be important to establish the range of variation of the measurements of the Turgai hare from adequate material. The labels of the pelts have the following data: length of body with head 525, 550, 580 mm; hind feet 150 mm; ear 120, 128, 135 mm. Weight 3.855-4 kg.

Length of skull 102.5 mm; condylobasal length 90 mm; zygomatic width 50 mm; length of upper tooth row 18 mm.

GEOGRAPHICAL DISTRIBUTION. Astrakhan and Ural steppes. Northern boundary of range of type subspecies not certain. In the Astrakhan steppe, the boundary apparently follows 49.5°N rising on the Ural up to Uralsk. It turns to 49°N in the east reaching the vicinity of Temir. It occurs along the Emba river farther south, in the region of the Bol'shie Barsuki, in the Kara-Kum as far as Kazalinsk, Chelkar and Kara-Uzyak.

Lepus e.c. natio kalmykorum occurs in the Kalmyk steppes. It is not known how far north it occurs.

The exact boundary of the range of L.e.c. natio turgaicus is also not certain, but it occurs north of Uralsk. Specimens from near Uralsk are apparently intermediate between the true caspicus and its northeastern natio.

L.e.c. natio turgaicus occurs in the Orenburg, Orsk, and Kustanai steppes.

In the north of the Nizhni Novgorod Territory, in the Vologda District, Votskii Region, Bashkiria, a form occurs which rarely becomes white in winter. The relationship between this form and L.e.c. natio turgaicus should be determined. The furriers distinguish a very large Menzelinsk strain in this area. To judge by our limited material, the Turgai hare is not very large. It is closely related to the Caspian common hare in this respect. The east Vologda hares probably form a separate natio of the subspecies hybridus.

The northwestern boundary of L.e.c. natio turgaicus is thus, so far, unknown.

158. Lepus (Eulagus) tolai tolai Pall. (1778). Tolai hare

1778. Lepus tolai Pallas P.S., Novae species Quadrupedum e Glirium Ordine, pp. 17-28.

162 1811. Lepus tolai Pallas P.S., Zoographia Rosso-Asiatica, p. 149.

1859. Lepus tolai Maak R., Puteshestvie na Amur (A Journey to the Amur), Sankt Peterburg, p. 108.

1862. Lepus tolai Radde G., Reisen im Süden von Ost-Sibirien, S. 211-215.

1910. Lepus tolai Kashchenko N.F. O kollektsii mlekopitayush chikh iz Zabaikal'ya (A Collection of Mammals from Transbaikalia), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, p. 272:273; KashtchenkoN.F., Novye issledovaniya po mammologii Zabaikal'ya (New Studies of the Mammals of Transbaikalia), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, XVII, pp. 396-397.

1927. Lepus tolai tolai Allen Gl., Lagomorphs Collected by the Asiatic Exped., Americ. Mus. Novit., No. 284, pp. 6-7.

1929. Lepus tolai Formozov A.N., Mlekopitayushchie severnoi Mongolii (Mammals of Northern Mongolia), Izdatel'stvo Akademii Nauk, pp. 95-96.

1929. Lepus tolai Kuznetsov B.A., Zverovye promysly vostochnogo Zabaikal'ya (Animal Trade in Eastern Transbaikalia), Trudy po lesnomu opytnomu delu, Tsentral'naya lesnaya opytnaya stantsiya, Issue VI, p. 93.

1930. Lepus tolai Vinogradov B.S., Rukovodstvo k opredeleniyu gryzunov Srednei Azii (Key to Rodents of Central Asia), p. 50 (partim!). (The author considers the tolai hare as identical with the desert hare!).

1933. Lepus tolai tolai Lukashkin A.S., Zveri stepnoi Bargi v ikh biologicheskikh osobennostyakh (Biology of the Mammals of the Barga Steppe), p. 78.

NAMES: The Tolai Hare (English); Tolai Hase (German).

LOCAL NAMES: "Kamennyi zayats" (stone hare), tolai, tolui, tulai (Transbaikalia); ranchvo (Tangut); tun-tu-ula (according to A.Cherkasov, in Transbaikalia).

TYPE LOCALITY AND DEPOSITION. The valley of the Selenga river should be considered as type locality of the Tolai hare. At the beginning of the description of Lepus tolai, Pallas ("Novae Species Qudrupedum e Clirium Ordine", 1778, p. 18) writes: "Caeterum in montibus apricis campisque rupestribus vel arenosis circa Selengam ubi Lepus rupestris (Kamennoi Saiz) inter Russos audit, uti per omnem quoque Mongolian atque Davuriam, husquam deest, frequentior ibi Lepori variabili; ad Septentrionem contra Baikalis non observabilis".

Glover Allen (loc. cit, 1927) considers the Gobi hare (described by K. A. Satunin) as a synonym of the Tolai hare, and states that the Gobi Desert should be considered as terra typica of the Tolai hare.

This is unacceptable. The first exact geographical reference is usually considered as terra typica. As mentioned above, Pallas indicates the Selenga Valley (p. 18). He mentiones in the same book (p. 20) that the Tolai hare definitely occurs in the Great Gobi Desert as far as Tibet ("Certe in deserto magno Gobeënsi ubique ad Tybetum usque vivit... ").

These supplementary data at the end of the description of the Tolai hare cannot be considered as indication of its terra typica.

Principal figures: 1) Schreber J. Ch., Die Säugetiere, IV, 1792, S. 878-881, Tab. CCXXXIV (color plate of entire animal); 2) Dvigubskii I, Opyt estestvennoi istorii vsekh zhivotnykh Rossiiskoi imperii (Natural History of the Animals of the Russian Empire), 1829, p. 43, pl. 25 (entire animal); 3) Simashko, Yu. Russkaya fauna (Russian Fauna), II, 1851, p. 778, pl. 61, fig. 1 (color plate of entire animal); 4) Radde G., Reisen im Süden von Ost-Sibirien, 1862, S. 211-215, Taf. VIII, Fig. 2a-c (black pattern of tips of ears); 5) Brehm, Tierleben. Säugetiere, II, 1914, Taf. III, Fig. 1 (photograph of entire animal).

MATERIAL EXAMINED: 15 pelts and skulls.

DIAGNOSIS. Head relatively large. Ear when stretched (measured from occiput) 1 1/5-1 1/3 as long as head, i.e., much shorter than ear of desert hare.

Tail, including terminal hair, about 85-95% of length of hind foot (without bones), i.e., relatively long.

Tail in summer and winter fur white, with contrasting black or black-brown dorsal side.

The fur does not become much whiter in winter, but is much fluffier, 163 denser and softer than summer fur. Color of winter fur varies. In some specimens it is yellower than the summer fur, and the lower part of the back is much grayer. In other specimens, the gray color covers a larger part of the back.

Winter fur very soft, silky; guard hairs rather thin, straight. Summer fur much coarser than in desert hares, but more delicate than in common hares.

Curliness not observed.

Teats 6.

Length of nasals (measured along line from inner anterior margin to outer posterior margin) either slightly longer, or as long as, frontal suture. Maximal width of both nasals (measured posteriorly) usually much exceeding length of the postorbital process.

The lateral contours of the posterior third of the incisive foramina are usually markedly widened in Transbaikal Tolai hares, often with slightly curved lateral projections; posterior third of incisive foramina of Manchurian Tolai hares only slightly widened.

The lower anterior molar is sharply inclined backwards in profile.

Mandibular condyle compressed, moderately inclined backwards.

Lower posterior plate of mandible (from angular process to notch at beginning of horizontal process) broad.

Distance between angular process to notch at beginning of horizontal mandibular process much greater than that between anterior alveolus of first molar and tip of lower incisor.

Bullae osseae large, markedly inflated. Bullae projecting anteriorly in profile, rounded.

Length of skull 87-95.2 mm (M. 90.6 mm); zygomatic width 42.3-47.8 mm (M. 44.6 mm); length of nasals 36-41 mm (M. 38 mm); width of nasals 15.3-19.3 mm (M. 17 mm).

Length of body with head 430-580 mm (M. 492 mm); hind feet 110-135 mm (M. 123.6 mm); ear (along concavity) 85-115 mm (M. 94.9 mm); tail (without terminal hair) 75-110 mm (M. 92.6 mm).

ADDITIONAL DESCRIPTION. The skull of the Transbaikal Tolai hare closely resembles that of the common hare. It is a transitional form between the desert hare and the common hare, but it has some special characters. The skull of the Transbaikal Tolai hare differs from that of the desert hare as follows: 1) larger size; 2) greater thickness and width (especially at the base of the nasals, which in most Tolai hares are broader than in desert hares); 3) ratio of length of nasals to that of frontal suture usually different from that of the desert hare; 4) shorter bony palate; 5) broader incisive foramina (Figures 84-87).

The Transbaikal Tolai hare resembles the common hare in these characters. A further resemblance between them is that, in both species, the lateral contours of the posterior third of the incisive foramina have rounded protuberances.

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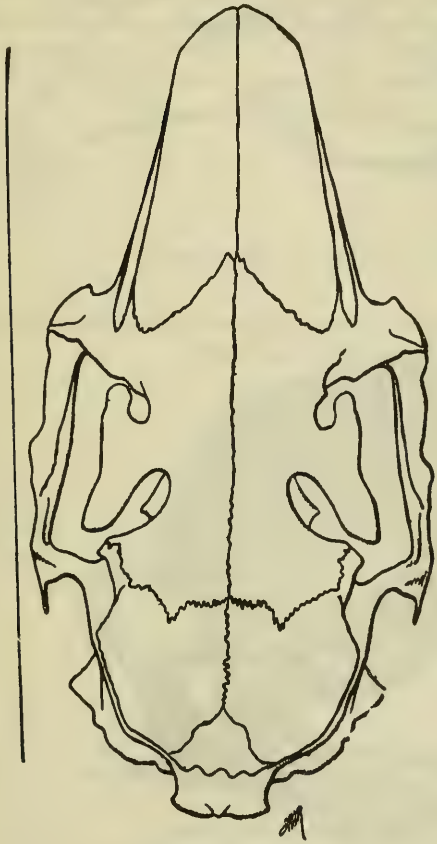

FIGURE 84. Tolai hare, Lepus tolai tolai Pall. No. M.2323, 16 January 1928. Vicinity of Troitskosavsk [Kyakhta], P.S. Mikhno, S.I. Ognev's collection, skull dorsal

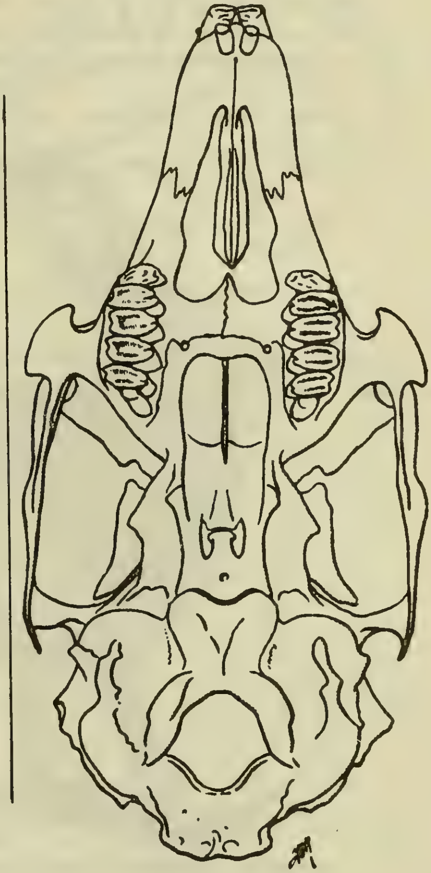

FIGURE 85. Tolai hare, Lepus tolai tolai Pall., skull ventral

165 Rows of molars of Tolai hare longer than those of desert hare; diastema longer.

In addition to the above characters which resemble those of the common hare, the skull of the Tolai hare has some specific characters. Posterior plate of mandible large (as in the blue hare); mandibular condyle more massive than in the desert hare or even the common hare; condyle resembling that of the blue hare to some extent; the posterior part of the zygomatic bone which delimits the orbit ventrally, is obliquely elevated, the orbit thus becomes narrower than in the blue hare.

164

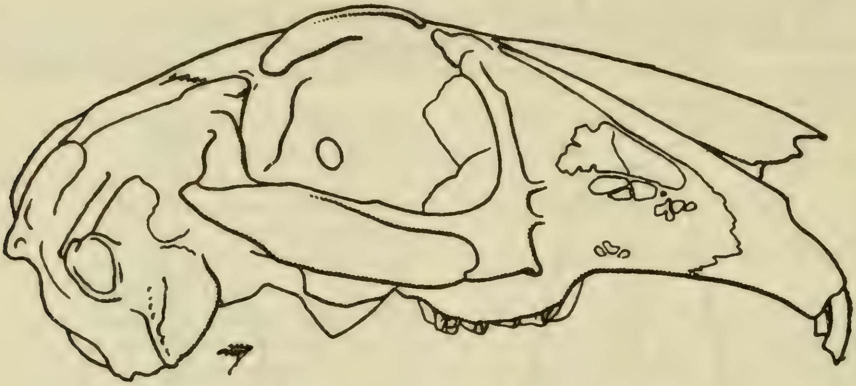

FIGURE 86. Tolai hare. Lepus tolai tolai Pall., skull lateral

165 COLOR. Summer fur. General color of back grayish straw-earth with a slight rust tinge. A yellowish straw-clay tone on flanks.

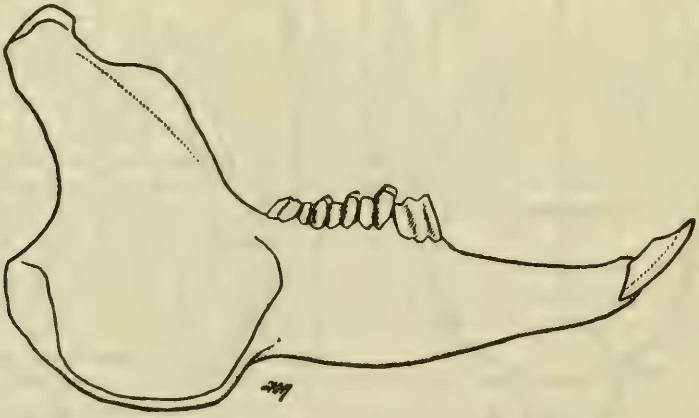

FIGURE 87. Mandible of Lepus tolai tolai, specimen No. M. 2323
Drawing by Yu. A. Kostylev

Color of top of head similar to that of back but occasionally darker because of the stronger admixture of black hairs. Color of anterior part of head (near muzzle), cheeks, and sides of neck dull, gray-brown-straw-colored (intermediate between avellaneous and light pinkish cinnamon).

Neck dull, straw-rust with a vinaceous tinge (intermediate between avellaneous-vinaceous-buff and pinkish cinnamon).

Chin and upper part of throat white.

A straw-gray stripe of varying intensity across the chest. Its color is either: 1) a straw tinge mixed with gray (avellaneous); 2) a stronger rusty tinge (light cinnamon); or 3) a well marked gray shade (intermediate between mouse-gray and light mouse-gray), because of the gray hair roots in this region.

Anterior margin of inner side of ears brownish earth-colored with a fine speckling of straw color.

166 A broad whitish straw stripe along the outer side of the anterior inner margin. Inner side whitish with a slight gray tone. A pale straw-rust-colored fringe on the distal part of the inner margin. Outer surface whitish with a marked grayish or straw tinge.

Anterior sides of forelegs dull straw-yellow with a slight clay tinge. The relative purity of this tone is changed in some specimens by the grayish brown hair tips, and in some specimens by some grayish brown guard hairs.

Soles of hind feet white with a dirty straw-gray tinge.

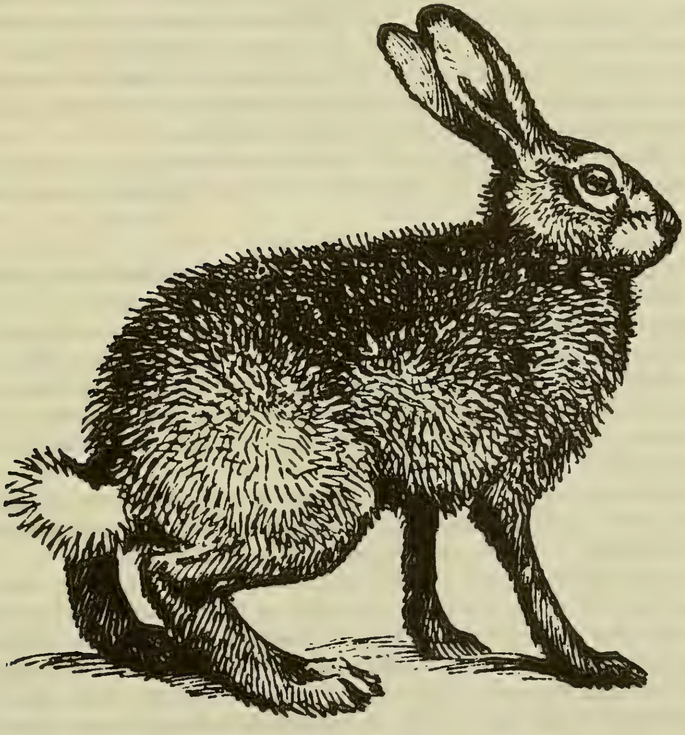

FIGURE 88. Tolai hare, Lepus tolai tolai Pall.
Drawing by A. N. Kamarov

The general color of the Tolai hare resembles that of several southern forms of the common hare, e. g., the Caucasian common hare. There are also rare specimens with a lighter grayish color. To this group belongs, for instance, specimen No. M. 3311, 1 July 1927, collected between Lake Tsagangol and Lake Barun-Tsaidan, Transbaikal, S.I. Ognev's collection.

The general tone of the back of this specimen is dull, grayish straw with well marked black speckling especially in the middle of the back, where the light hair tips are worn off. Color of top of head almost like that of back.

Nose and cheeks grayer and lighter (intermediate between light drab and vinaceous-buff).

Color of neck dull straw-gray with a slight rust tinge.

Anterior inner parts of ear dull straw-gray with black speckling. A broad white stripe along the outer edge of the anterior inner margin. Inner sides whitish with a marked gray tone. A whitish stripe along the outer margin. Outer side dirty-whitish gray. Tips of ears with a narrow blackish fringe.

167 Color of anterior side of forelegs straw-gray with a rust tone. Hind legs whitish with a straw tinge on the dorsal part of the feet.

Winter fur. Ground color of back pale, straw-yellow with a dark rust-vinaceous tinge intermediate between avellaneous and light pinkish cinnamon, strongly mottled in a blackish-brown pattern.

Color of top of head similar to that of back. Color of sides of head without the rust tones characteristic of common hares. Ground color dull straw-gray with a vinaceous tinge (intermediate between vinaceous-buff and light pinkish cinnamon). This ground color is mottled with a characteristic blackish pattern which is especially marked on the cheeks under the eyes and in the postorbital region. Streaks of blackish hair on anterior part of muzzle and near the roots of vibrissae.

Neck dull, straw-rust-vinaceous. Color of roots of hair intermediate between avellaneous and pinkish cinnamon, but hair appears paler because of the whitish hair tips.

Chin and throat white with a light straw tinge.

Color of stripe across chest pale straw-yellow (intermediate between light pinkish cinnamon, vinaceous-buff and pinkish cinnamon).

Anterior inner margin of ear of blackish color overshadowing the straw ground color. Outer fringe of inner margin pale straw. Inner side covered with white hair with a rich straw tinge, especially marked on the tips. Color of inner margins of posterior side straw-rust colored (light pinkish cinnamon). A large elongate white spot on the outer margin of the outer side. Tip of ear with a black stripe.

Color of forelegs pale straw-rust. Belly and groin pure white. The pale straw-rust color of the flanks also enters the inguinal region, forming two irregular, indistinct stripes.

There is a very light winter specimen of the Tolai hare in my collection (No. M. 3310 male, 19 January 1928, vicinity of Troitskosavsk [Kyakhta]). General color of this specimen whitish gray with a slight straw cast and a blackish tinge in the middle of the back, which is caused by black guard hairs and the blackish tips of some hairs. Flanks whitish with slight gray tinge. Head whitish straw-gray with more grayish tinge on the cheeks. Straw-gray stripe hardly perceptible across the chest. Whole ventral part (except the chest) white with a slight straw tinge.

Specimen No. M. 3772 female ad. 30 November 1929, vicinity of village Mirolyubovka, left bank of Irtysh (Samarskoye District) is also very light colored. The general color of the back of this specimen is whitish with a
168 rust-straw tinge (pinkish cinnamon) caused by pale straw-rust subapical parts of the guard hair, which is mixed with some completely black or brownish black hair. Anterior part of head, forehead and cheeks white. Flanks whitish with a slight straw-rust tinge. Straw-rust stripe across chest indistinct, almost invisible on the generally whitish background. Belly pure white. Yellowish straw ears with a strong white tinge.

Color of summer fur of young dull gray with a straw tinge and blackish brown speckling. Color of the stripe across the chest dull straw-gray (intermediate between light-drab and vinaceous-buff). The color of the Tolai hare is grayer, without rust tones, compared with young specimens of Central Russian common hares of the same age. Fur of young L. tibetanus lehmanni much lighter than that of Tolai hare, with predominating straw-gray tones.

SYSTEMATIC NOTES. I stated in the article: "Zur Systematik der russischen Hasen" that the Tolai hare should be considered as a subspecies of the common hare.

Having examined extensive material, I now consider the Tolai hare as a separate species. It is true that it has much in common with the small subspecies of the common hare such as L. e. cyrensis and L. e. caspicus. However, the following characters justify the consideration of L. tolai as a species closely related to the common hare, but not as a subspecies: 1) some cranial differences; 2) the soft fur; 3) the relative shortness of the ears, etc.

It does not seem justified to include the Tolai hare in the group of Central Asian hares. The Tolai hare shows clear, constant cranial differences. It seems to constitute a transition from tibetanus to europaeus in some respects, but it also has special morphological characters such as the form of the orbit, the structure of the mandibular condyle etc. (see above).

As stated above, Glover Allen (1927) considers L. gobicus as identical with the Tolai hare, and makes it a synonym of this (see above).

However, as the terra typica of the Tolai hare is not the Gobi Desert, but the valley of the Selenga river, L. gobicus cannot be synonymous with the Tolai hare. L. gobicus is closely related to the Tolai hare. The winter fur of L. gobicus is characterized by a clay color which differs from that of the winter fur of the Tolai hare.

After comparing the Gobi hares with L. centrasiaticus of the tibetanus group, I found that they are very similar. The Gobi hare is possibly a natio or a subspecies closely related to centrasiaticus.

A.S. Lukashkin sent me several skulls of Tolai hares from northern Manchuria, along the eastern side of the Great Khingan. Apart from these skulls, I have only one pelt obtained 13 November 1934 in the valley of the Ivangol river, a right tributary of the Nonni [Nun Kiang] river, near the Santien locality, 30 km north of the Chalantun Station of the East China Railway. This pelt resembles that of the Transbaikal hare, but
169 it is much smaller: length of body with head 480 mm; tail 112 mm (without terminal hair); ear 85 mm; hind feet (without claws) 115 mm. Weight 2.5 kg.

The skull of Tolai hares from north Manchuria is smaller than that of specimens from Transbaikalia.

Measurements of skull of north Manchurian Tolai hare: length of skull 84-88.2 mm; condylobasal length 76.2-78 mm; zygomatic width 40.5-43.6 mm; length of nasals 36-40.3 mm; width of nasals 17.2-18.7 mm; width of skull at level of auditory apertures 33.2-34.6 mm; length of bony palate 6.2-7.3 mm; width of incisive foramina 8.1-9.5 mm; length of row of upper molars 15-15.5 mm.

170 It would thus be possible to consider the Manchurian Tolai hare as a separate subspecies. However, I am waiting for more material to make this description more accurate. It is especially necessary to determine the relationship between the Manchurian Tolai hare and the Gobi Desert hare.

In spite of the limited material, it can be stated that the following cranial characters of the Transbaikal Tolai hare are also present in the Manchurian form:

1) short postorbital processes; 2) width of nasals in their posterior third (longer than postorbital process); 3) short nasals (as long or slightly longer than frontal suture); 4) mandibular condyle massive, etc.

Lepus quercerus from the Chuya Steppe and its systematic position will be discussed in the chapter on the desert hares.

GEOGRAPHICAL DISTRIBUTION. The Tolai hare is widely distributed throughout southern Transbaikalia, where it occurs near Troitskosavsk along the Selenga river, near Verkhneudinsk [Ulan-Ude] in the Aga Steppe, the Steppes of Dauria, Onon river valley, near Kulusutai. It occurs near Lake Tarei-Nor, Dalai (Hulun)-Nor, Buir-Nor (G. Radde, 1862) near Lake Koso Gol, in the upper reaches of the Irkut river (Radde, 1862). A pelt and skull of a Tolai hare from the eastern Sayans, near the village of Mondy, 25 km north of Lake Koso Gol is in my collection. I also consider as a Tolai hare a specimen with an aberrant coloration obtained in the Samarskoye District, on the left bank of the Irtysh. The boundary of the range of the Tolai hare is apparently very close to that of the desert hare (L. t. lehmanni) in this area.

The American Expedition found Tolai hares in northern Mongolia, 30 miles south of Ulan-Bator (Urga), and also south of Uliassutai [Jibhalanta] near Tsagan-Nor, Argabogdo, Ula-Usa.

A.N. Formozov (1929) caught Tolai hares near Lamen-Üegen, in the lower reaches of Tuin-Gol, on the northern coast of Lake Üreg Nur, in Yihe-Bogdo (Gobi Altai), along the river Aidarik, in the valley of river Dzabhan Gol.

The Tolai hare is thus apparently widely distributed in northwestern and Central Mongolia. K.A. Satunin (1907) described the Gobi hare from northern Gobi, apparently a subspecies of tibetanus closely related to Lepus tibetanus centrasiaticus Sat.

Towards the east, R. Maak (1851) recorded the Tolai hare along the Argun [Ehrkuna Ho]. He thinks that it occurs south of Aihun, on the way to Tsitsihar. According to A.S. Lukashkin (1933) it occurs in the Barga [Hulun-Buir] District* of the Heilungkiang Province, Manchuria. This region is an eastward continuation of Russian Transbaikalia in its general character. According to A.S. Lukashkin, the Tolai hare occurs in large numbers between the Manchouli and Hailar stations, near the Station Heierhungteh.**

171 MODE OF LIFE. Our knowledge of the mode of life of the Tolai hare is unfortunately very incomplete. B.A. Kuznetsov (1929) states that it lives among Arctic dwarf birch in ravines and among shrubs in tidal marshes of Transbaikalia.

A.N. Formozov writes: "The favorite habitats of the Tolai hare in Mongolia are two completely different biotopes. The hare is most numerous in river valleys (Tuin-Gol, Dzabhan Gol, Murin-Gol rivers, etc.) and lake basins (Üreg-Nur). One can find three or four during half an hour in these places, in thickets of tall Lycium halimifolium Mill., shrubs of Caragana spinosa, Nitraria schoberi and willows. The animal is rapid and hides quickly behind mounds and vegetation when seen by men.

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* [Now in the Inner Mongolian Autonomous Region.]

** As stated above, local Tolai hares differ sharply from Transbaikal specimens. They should be carefully described from extensive material.

"We were surprised to find them high in the mountains (on the Yihe-Bogdo, to an altitude of 8000 feet), in meadows with many marmot burrows. Tolai hares calmly sit here on marmot mounds. They let the hunter approach closely, and then hide in the burrow. It is useless to wait for their reappearance. They were found near marmot burrows also in Laman-Gegen. There were only a few in meadows with numerous marmots and susliks. Only once did we find them in rocky desert covered with pea-shrubs. The diet of this hare is unknown. On the Üreg-Nur, the Tolai hare fed on Nitraria berries. Tolai hares apparently have at least two litters during summer. We found at the same time large young hares and suckling females."

A.S. Lukashkin (1933) reports that the Tolai hare lives in river valleys and in the sandy Barga Steppe overgrown with willow thickets, in the Heilungkiang Province of Manchuria*. He also reports that in Barga the Tolai hare has only two litters per year. Litters in September are very rare.

Tolai hares occasionally occur near human settlements.

A.S. Lukashkin writes that in the vicinity of Hailar, the Tolai hare is often hunted close to the villages, near gardens of the Chinese which it enters from the open steppe. He found the lair of a hare 30-40 steps from the Chinese huts. The dogs of the Chinese sit on the roof of the huts for days, barking. However, the Tolai hare lies calmly and fearlessly under a willow or in a hollow on the ground.

The Tolai hare had no commercial value in Manchuria until recently, as its fur is of inferior quality. Only recently did an English food-export company begin to manufacture canned and frozen meat products for export to England.

This firm exported about 6000 dressed hares from the Heierhungteh Station in December 1927. The firm hired eight hunters, who killed 60-80 hares daily in spite of the severe cold at the time. These figures show that the Tolai hare is very numerous and widely distributed in Barga.

172 According to A.S. Lukashkin ("Okhotnichii i pushnoi promysel na Bol'shom Khingane" (Hunting and Fur Trade on the Great Khingan), "Vestnik Man'chzhurii" No. 5, 1934, p. 140) the Tolai hare occasionally produces hybrids with small local blue hares. These hybrids are called Tumacs, like the hybrids of the common and blue hare.

159. Lepus (Eulagus) tibetanus Waterhouse (1841). Desert hare

1841. Lepus tibetanus Waterhouse G. R., Proceedings Zoological Society of London, pp. 7-8 (Little Tibet).

NAMES: The Afghan hare, the desert hare (English); der Hase von Westtibet, der Wüstenhase (German).

LOCAL NAMES: kuyan, or koion (Kazakh, Kirghiz); taushan (Turkmenian); khar-gush ("Donkey's ears" - Persian).

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* [Now in the Inner Mongolian Autonomous Region.]

PRINCIPAL FIGURES: 1) Blanford W. T., Eastern Persia II, Zoology 1876, pp. 80-82, pl. VIII (color plate of entire animal under the name Lepus craspedotis); 2) Blanford W. T., Scientific Results of the Second Jarkand Mission, Mammalia, 1879, p. 63, pl. IV, fig. 2 - Lepus tibetanus (entire animal in color); 3) Blanford W. T., l. c., 1879, pp. 67-68, pl. V, fig. 1 (entire animal in color); pl. Va, fig. 1-1b (skull) - Lepus pamirensis; 4) Blanford W. T., l. c., 1879, pp. 68-71, pl. V, fig. 2 (entire animal in color); pl. Va, fig. 2-2b (skull) - Lepus stoliczkanus; 5) Bogdanov M. N., Ocherki prirody Khivinskogo oazisa (A Survey of the Nature of the Khiva Oasis), 1882, p. 68 (half tone plate of entire animal under the name Lepus kessleri); 6) Marcus Word Layon, Classification of the Hares and their Allies, Smithsonian Miscellaneous Collections, Vol. I, parts 3 and 4, 1904, pl. LXXXIV, LXXXV, fig. 4 (photograph of skull dorsal and ventral - Lepus tibetanus); 7) Kashkarov D. N., Zhivotnye Turkestana (Animals of Turkestan), 1932, p. 196, fig. 140 (under the name Lepus tolai lehmanni); 8) Heptner V. G., Zaitsy (Hares), Moscow, 1933, p. 23, fig. 3 (entire animal); 9) Vinogradov B. S., Pavlovskii E. N., Flerov K. K., Zveri Tadzhikistana, ikh zhizn' i znachenie dlya cheloveka (The Life of the Animals of Tadzhikistan and their Importance to Man), 1932, p. 252, fig. 86 (in summer fur); p. 254, fig. 87 (in winter fur, under the name Lepus tolai Pall.).

MATERIAL EXAMINED: 74 specimens.

DIAGNOSIS. Head relatively small.

Length of ear (measured from occiput) 1.25-1.75 times as long as head.

Length of tail with terminal hair about 4/5 of length of hind foot (without claws).

Tail white with contrasting black of black-brown dorsal side in summer and winter fur.

Hair not becoming white in winter. Winter fur only lighter (changing its tone) and slightly different from summer fur in being fluffier and denser.

Fur very soft, silky. Guard hairs soft, delicate and straight. Fur not curly.

Teats 8. Nasals measured along line connecting inner anterior corner with outer posterior corner usually longer than frontal suture.

Maximal width of both nasals in their posterior part about equal to length of postorbital process, rarely exceeding it.

Posterior third of incisive foramina widened, without protuberances, and with straight margins.

Anterior lower molar sharply inclined backwards in profile.

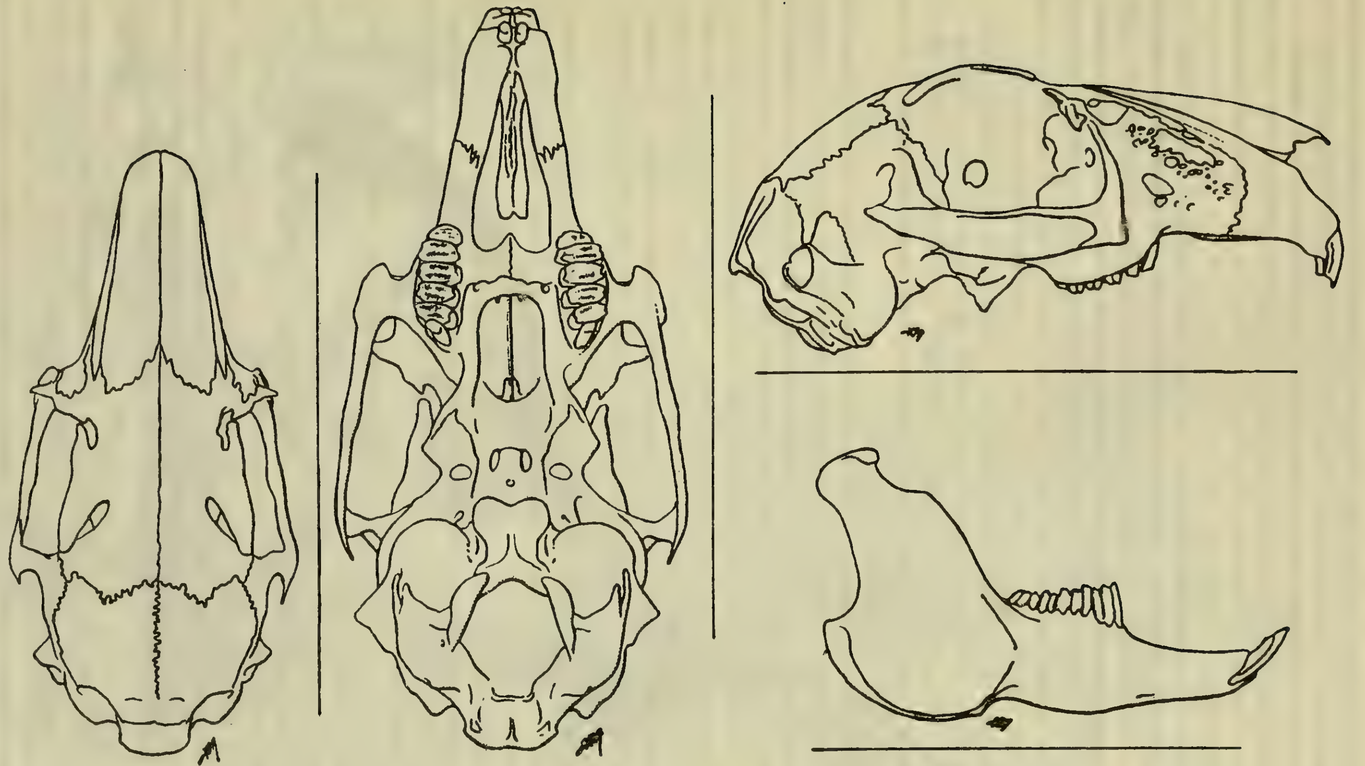
173 Mandibular condyle weak, strongly inclined backwards.

Lower posterior plate of mandible (from corner of angular process to notch at beginning of mandibular horizontal process) weak. Distance between angular process to notch at beginning of mandibular horizontal process much greater than that between anterior alveolus of first premolar to tip of lower incisor. The lower posterior mandibular plate of the common hare is also rather weakly developed. However, the skull of the common hare differs from that of the desert hare as follows: 1) the ratio between the two measurements mentioned above is the opposite of that of the desert hare; 2) the lower diastema of the desert hare is much shorter, and the whole mandible is thus little elongate anteriorly and relatively short. This distinguishes the desert hare from the common hare.

Bullae osseae larger, strongly inflated. The rounded bullae osseae protrude markedly anteriorly in side view (Figures 89-92).

Length of ear from occiput 100-145 mm; hind feet 106-130 mm.

ADDITIONAL DESCRIPTION. The skull of the desert hare is very similar to that of the common hare; in some respects it is a miniature of it. However, there are the following differences: 1) bony palate of desert hare relatively wider than that of common hare; 2) incisive foramina narrower, sides of their posterior third usually without



FIGURES 89-92. Skull of desert hare, Lepus tibetanus bochariensis Ogn. No. M. 3060 22 May 1914. Khatyn - Rabad east of Termez. N. A. Bobrinskii (type), S. I. Ognev's collection

Drawing by Yu. A. Kostylev

173 protuberances; 3) ratio between width of incisive foramina and length of bony palate different from that of common hare; 4) mesopterygoid fossa of desert hare narrower than that of common hare, and ratio between length of mesopterygoid fossa and of bony palate also different; 5) length of lower diastema and of mandibular process smaller than in the common hare; this affects the ratio between the length of the row of lower molars and the lower diastema.

COLOR. The color of the back of the desert hare varies strongly according to the locality. Mountain forms are as a rule darker than valley forms. According to Blanford, the color of the back varies from light gray[*] to rust-brown in the nominate subspecies, Lepus tibetanus tibetanus. Specimens of these two color types have a distinct black tinge. The lower part of the back is often sand-gray. The brownish gray ground color of the inner sides of the ears is mixed with black[**].

175 A specimen of Lepus tibetanus tibetanus No. 12393 female adult, 25 May 1879, collected by J. Scully in Gilgit is in the ZMAN collection. This locality is only a little north of the terra typica of L. tibetanus, adjoining the Pamir Plateau, but separated from it by the Hindu Kush and Karakorum massifs.

General color of back of this specimen dull grayish yellow mixed with blackish hair tips. Color of top of head like that of back, i.e., ground color straw-gray with fine blackish mottling. Anterior inner margins of ears of the same color. Black-brown hair on tip of ears gives a darker color to the apex. Broad black-brown fringes on the outer apical part of the ears. Flanks paler than back, with a dull straw-gray tone. Chest with a transverse dull straw-gray stripe (paler and grayer than avellaneous, Ridgway, pl. XL). Lower part of back grayer. Cheeks whitish gray, with blackish speckling. Eyes surrounded by a whitish ring.

The general color of this hare closely resembles that of the Pamir subspecies, and is almost identical with that of darker specimens of L. t. lehmanni.

Color of Lepus tibetanus subsp. from Kopet-Dagh similar to that described above; general color of back straw-gray with well marked blackish mottling. Inner margin of ears with a distinct blackish tinge on a straw-gray background.

The color of L. t. lehmanni also resembles that of L. tibetanus subsp. from Kopet-Dagh.

The dull tones of color with the blackish tinge are typical of a group of desert hares which could be called "relatively dark forms". This group also includes L. t. craspedotis.

A group of light-colored desert hares can also be distinguished. The color of the palest members of this group is very dull. For example, L. t. desertorum has an unusually pale straw-sand color in summer fur with a hardly perceptible blackish tinge. In winter specimens, the back has an irregular blackish mottling on a general light straw-yellow background. In some subspecies, the back has a rust-red tinge on a sand-straw colored ground (e.g., in *L. t. buchariensis*). The color of *L. t. pamirensis* and *L. t. zaisanicus* is more intense. In the latter, the color of the back is rather pale, straw-gray with a blackish tinge in summer fur.

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[*] The description of the type of L. tibetanus by G. R. Waterhouse (1841) differs sharply from the more recent description in Blanford's work. Waterhouse described the type from a specimen from Ngari (caught by Vigue near Skardu). Blanford described specimens from the valley of the Nutra river in Ladakh. The color of this hare is generally pale, according to Waterhouse, without any yellowish or rust tones. Hair on chest pale gray with slightly rust-colored hair tips. Ears very large, their inner margins pale gray.

[**] It is possible that specimens of the second color type from Ladakh, which were identified by Blanford as tibetanus, belong to another form. This can only be determined by comparison of material.

As stated above, the color of the summer fur differs little from that of the winter fur, which is often darker than the summer fur with a slight black tone caused by the blackish brown tips of the long guard hairs or by black-brown parts of some hairs on the back.

General habitus of desert hare light and graceful. Its ears seem long, its haunches thin and its tail protrudes markedly.

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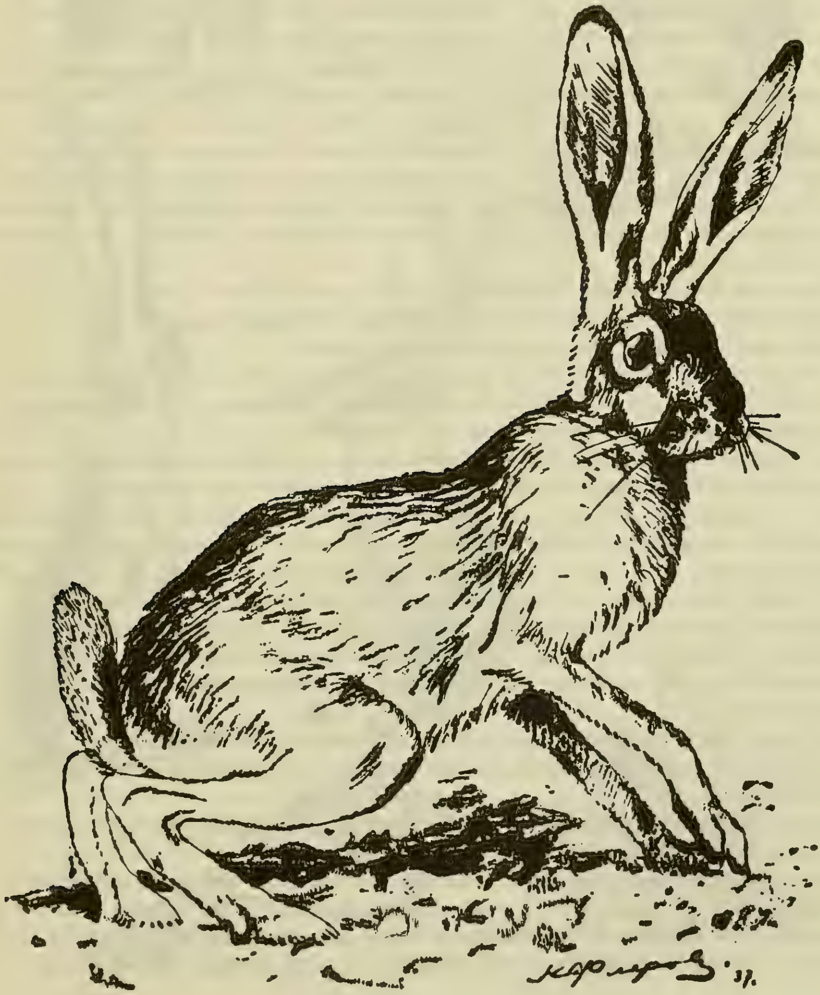

FIGURE 93. Desert hare, *Lepus tibetanus buchariensis* Ogn., Lower Vakhsh, Tadzhikistan, 1932 Drawing by K. K. Flerov

SYSTEMATIC NOTES. The opinions of authors on the systematic relationships between the various forms of desert hares differ sharply. Authors like Blyth, Hodgson, Blanford, etc. considered some desert hares as separate species. They (e.g., Blanford) pointed out, however, the close relationships between them, and their great resemblance.

W.G. Heptner* has recently proposed a new classification. He suggests considering the small hares of the Mediterranean subregion, L. granatensis, mediterraneus, parnassius and creticus, as subspecies of Lepus europaeus, but also subspecies of true desert hares such as L. judeae, tibetanus, lehmanni and tolai. 178 Heptner considers all these forms as one species group (Rassenkreis), but he excludes from this L. oiostolus, L. hypsibius, L. pallipes and L. kozlovi. This seems correct, as all these forms are clearly distinguishable from the common hare. However, there is much evidence against considering the common hare, the Tolai and desert hares as one species, as proposed by this author.

We should like to stress the well marked cranial differences between the common and the desert hares (see above). The structure of the palate of the Central Asian hares closely resembles that of Lepus americanus. The same applies to the ratio of the length of the row of lower molars to the lower diastema. It is significant that the Central Asian hares resemble the American hares more closely than the common hare in these important cranial characters.

The Central Asian hares differ from the common hare also in the following characters: 1) fur very soft, silky; 2) guard hair relatively thin, silky and not curly as in many common hares.

The range of the common hare does not overlap that of the desert hare. The common hare is restricted to the European continent. It apparently has a southern, Mediterranean focus of distribution.

In the course of evolution the southern forms of the common hare became sharply different from the typical race and developed into separate species.** These forms have good color and cranial characters. Some of these recently developed species occur on islands: Lepus granatensis (Balearic Islands), L. mediterraneus (Sardinia), and L. creticus (Crete). Other species occur in the southern parts of Europe, in the Mediterranean subregion (Spain, southern Greece). Miller (Catalogue of Mammals of Western Europe, 1912) shows that these species differ sharply from the true common hare in their measurements, color and skull characters.

As we have little material, we cannot at present reject Miller's analysis of the relationship between the Mediterranean hares and the true common hares.

The common hare apparently spread from its southern European focus, but its exact location cannot be determined at present.

This emigration took place towards the north, east and the southeast. It increased during the last century owing to the felling of forests and cultivation. The ranges of the common hare and the desert hare (L. t. lehmanni) became adjacent in Kazakhstan (in the former Syr-Darya

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* G. Heptner, Systematische und tiergeographische Notizen uber einige russische Säuger. Folia Zoologica et Hydrobiologica, Bd. VI, No. 1, 1934, S. 21-23.

** There are no transitions between these forms and the true common hares.

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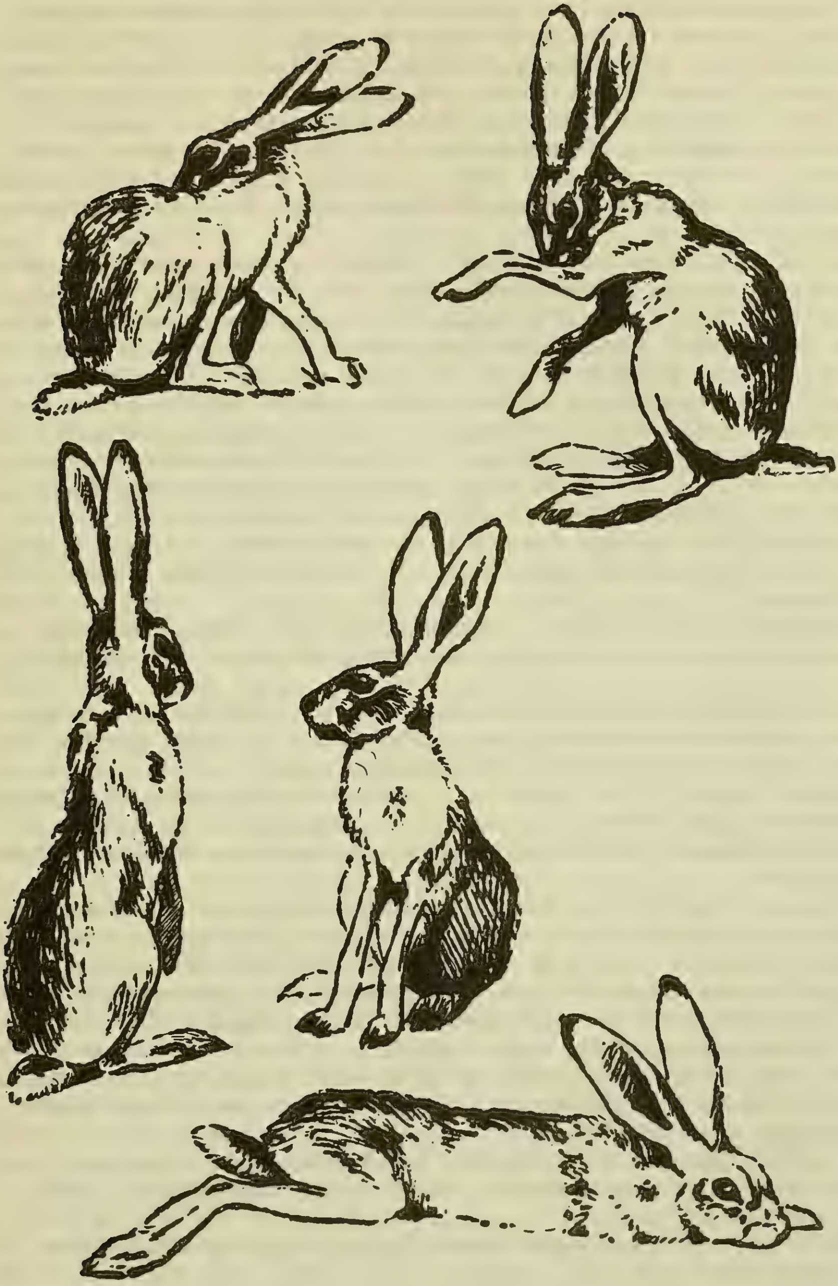

FIGURES 94-98. Postures of the desert hare, Lepus tibetanus buchariensis Ogn.
Drawing by K. K. Flerov

Region) and these two sharply different species occur together in this
179 region. The true common hare also spreads eastwards. The general appearance of common hares occupying new territories changes in some respects. It is possible that in the future the range of the common hare will reach the range of the true Tolai hare, but not that of the desert hare.

It seems probable that the center of dispersion of the desert hare was Central Asia. It is very widely distributed at present in this area and forms many subspecies. As pointed out, the Central Asian desert hares have much in common with some American hares, e.g., L. americanus, in some cranial characters, especially the structure of palate and incisive foramina.

The skull of L. americanus also shows the cranial characters of the blue hare, like the structure of the mandible, the upright position of the first lower molar, etc. The skull of the hares in the desert zone of Arizona (L. alleni Mearns) has characters of the common hare, but also some specific characters, such as a long braincase. This species has the following cranial characters: 1) coronoid and condyloid processes of mandible strongly inclined backwards; 2) lower diastema elongate; 3) lower molar inclined backwards; 4) incisive foramina wide; 5) sides of posterior third of incisive foramina with rounded protuberances. On the other hand, the skull of L. alleni has the following cranial characters which it has in common with the desert hare: 1) length of bony palate; 2) narrow mesopterygoid fossa; 3) markedly inflated and rounded bullae osseae.

The pale color of L. alleni, and the black color of the dorsal side of the tail are characters it has in common with the desert and common hares.

Without going into detail, it is interesting to note that the skull of the Central Asian hares, and also the general appearance in some species, have much in common with those of North American species.

A general survey of the specific and subspecific groupings of the Central Asian hares is given below. This survey is provisional as we have insufficient material on many species which we shall have to describe from the literature.

Lepus jarkandensis Günther (described from the valley of the Yarkand) is undoubtedly a good species. This small species has the following characters: very pale straw-yellow color (intermediate between pinkish buff and avellaneous), pale inner sides of ears (pinkish buff), straw-yellow flanks (pinkish buff), very pale chest, with a slight straw-yellow tinge on white ground. Color of tail typical; dorsal side of tail with a brownish straw-gray dorsal stripe which is yellow laterally (pinkish buff).

Color of summer fur similar to winter fur, but grayer. Straw-yellow
180 tones on chest more marked.

The skull of this species is typical: bullae osseae very large and inflated; roof of braincase flattened; sides of parietals parallel; bony palate very long.

There are transitional forms between L. jarkandensis Günther and the desert hare.

A large group of subspecies belongs to Lepus tibetanus Waterhouse (1841) which was described from a specimen from Skardu in northern Kashmir, and which occurs in Ngari. Lepus tibetanus tibetanus is a highland desert form, distinguished by a grayish color. The skull

(Marcus Ward Lyon, 1904) resembles that of the Pamir desert hare. The ranges of these two forms are adjacent. The following subspecies may be considered as belonging to L. tibetanus: Lepus tibetanus lehmanni Sev., L.t. pamirensis Blanf., L.t. buchariensis Ogn., L.t. stoliczkanus Blanf., L. tibetanus subsp.? (from Kopet-Dagh), L.t. craspedotis Blanf., L.t. zaisanicus Satun., L.t. desertorum Ogn., L.t. centrasiaticus Satun., L.t. quercerus Hollister, L.t. przewalskii Satun., L.t. gobicus Satun., L.t. kozlovi Satun.*

The Himalayan-Tibet hares which have completely white tails without black or black-brown color on the dorsal side are possibly a separate species, L. oiostolus Hodgson. To this color type belong the following species: 1) Lepus oiostolus Hodgson (1840) from Nepal and Sikkim which also occurs in Ladakh according to Hodgson; 2) Lepus pallipes Hodgson from Lhasa, considered by W.T. Blanford ("Fauna of British India", 1888, p. 452) as a synonym of L. oiostolus Hodgson; 3) Lepus hypsibius Blanf. This species is closely related to L. pallipes but differs from it in some external characters, such as color, measurements and skull structure (W.T. Blanford, Scientific Results of the Second Jarkand Mission. Mammalia, 1879, p. 61).

There is a large series of hares from northern and eastern Tibet, the upper reaches of the Hwang Ho, the vicinity of Shanerda, Nan Shan, Kuku-Nor, western Tsaidam (Valley of Winds), and Alyk-Nor, in the ZMAN collection. The hair of the back in these species is curly in winter fur, light rust-yellow, slightly pinkish. The lower part of the back is light smoke-gray; its color differs sharply from that of the middle of the dorsal side. These hares are determined as Lepus oiostolus Hodgson in the ZMAN collection. However Lepus oiostolus is distributed in Nepal and Sikkim; it is separated from the above-mentioned species by the large Tibetan Highlands. The identification as Lepus oiostolus is therefore doubtful.

The characteristic feature of L. oiostolus, the completely white tail, is also shown by some specimens of the series in the KZMAN. Thus the tail of a hare from the upper reaches of the Kara-Sai river (eastern Tibet, collected by Pevtsov) is completely white. The tail of a specimen from the Oi-Tulan-Khutum river (collected by Pevtsov) shows a darkening
181 in the proximal quarter of the dorsal side. The same character is also shown by a specimen from western Tsaidam (No. 12375), from the Valley of the Winds (collected by N.M. Przheval'skii). In hares from Gui-Dui, the Hwang Ho river, the Humboldt Mountains and other regions of eastern Tibet, the dorsal side of the tail is dark brown or black.

Presence or absence of black color on the dorsal side of the tail is a strictly constant character. The above data make it doubtful whether this character is constantly present in Central Asian hares, but this requires careful study and examination of a large amount of material.

Specimens of Lepus centrasiaticus (a subspecies of tibetanus) are closely related to east Tibetan hares. The color of the back in winter fur is very light, clay-yellow in these hares. The lower part of the back is whitish, the hair not curly. L. centrasiaticus Satun. is

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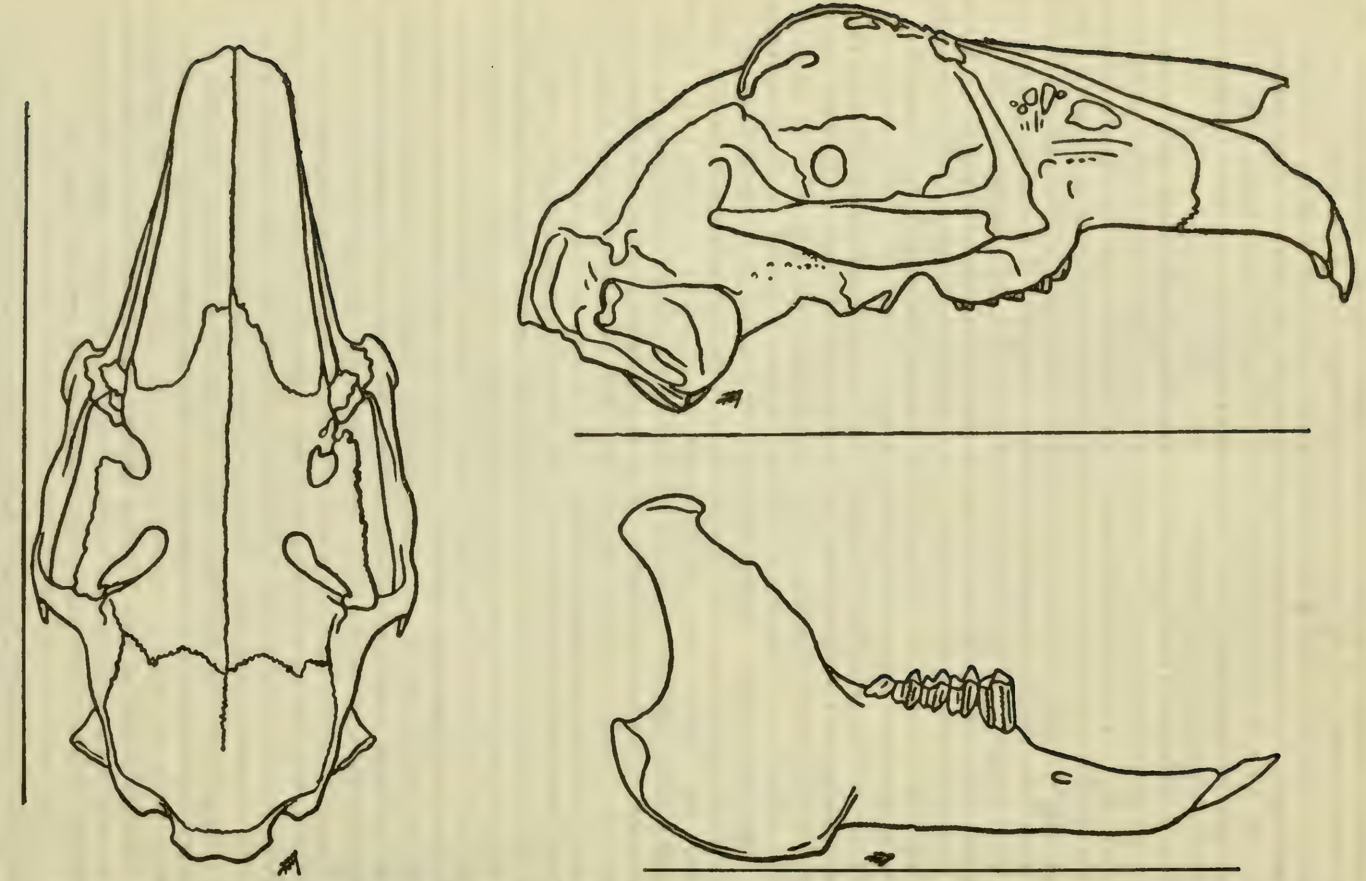
* Owing to lack of material, I cannot decide whether Lepus filchneri Matschie, L. aurigineus Hollist, and L. swinhoei Thos. belong to this group. Gl. Allen (1927) places L. tolai into this group as a subspecies.



FIGURES 99-101. Skull of Lepus tibetanus kozlovi Satun., female No. 13014. Nam-Chyu (Basin of Yangtze river). Tibetan expedition of P. K. Kozlov, ZMAN collection

Drawing by Yu. A. Kostylev

181 apparently distributed throughout Sinkiang, Hami [Qomul] and Kansu, and apparently also in Dzungaria. It does not occur in Ala Shan. There are specimens from Sachow, Ala Shan, Raskem, Etsin-Gol and Hami in the ZMAN collection.

L. t. centrasiaticus presumably occurs in the far north. It forms a more clay-colored, but still very light form, L. t. gobicus Satun.* in the Gobi Sands. It would be interesting to determine the relationship between this hare and the true Tolai hare, with which L. t. gobicus Satun. has some common traits.

Different hares occur in Tsaidam (Gas, southern Tsaidam). Specimens of Lepus t. przewalskii Satun. are closely related to L. t. centrasiaticus Satun., but their winter fur is even paler, more pinkish, with the lower part of the back white.

Hares from Khan are also typical (Nam-Chyu river, Basin of the Yangtze river, Gui-Dui, Re-Chyu, Bar-Chyu, collected by P.K. Kozlov). K.A. Satunin described them as a separate species, Lepus kozlovi Satun. They are characterized as follows: 1) nasals narrowed anteriorly; 2) anterior lateral part of skull low (in region of maxillaries and premaxillaries); 3) frontal area with elliptical depression in the interorbital region; 4) lower incisors markedly protruding anteriorly, pointing directly forward without upward curvature; 5) postorbital processes elevated in profile (Figure 100). This is one of the most typical characters of this form.

This form should be named correctly L. t. kozlovi. It has long ears, 130-140 mm along the concavity. Color of dorsum dark with a black tinge. Lower part of back different from the upper part by its dark ash-gray color.

Winter fur of L. t. kozlovi resembles that of some specimens of L. tolai tolai Pall. However, L. t. kozlovi differs from them in its long ears and markedly different skull structure.

183 The skull of L. t. kozlovi resembles that of hares from northern and eastern Tibet. However, the color of north Tibetan hares is much lighter; the lower part of the back, though grayer, is still lighter.

Thus, moving to the south in the Kahm mountains, one finds hares with a more intense color of the upper part of the back and with a grayer lower part of back.

Hares from Kansu, which is a transitional zone, were considered by K.A. Satunin as a separate species, Lepus gansuicus Satun. They are closely related to L. t. centrasiaticus Satun., and are apparently identical with it. Type No. 2854 (female, 3 June 1890, Kansu, Grum-Grzhimailo) is in summer fur and cannot therefore be compared with winter specimens of centrasiaticus. However, winter specimens of gansuicus (No. 2840, 8283, 2839, etc.) do not differ from centrasiaticus.

Finally, it should be mentioned that Lepus kaschgaricus described by K.A. Satunin is not monotypical. The specimen of kaschgaricus from the Yarkand Oasis first mentioned in K.A. Satunin's work certainly belongs to jarkandensis. Specimens of L. kaschgaricus from Tien-Shan and Yuldus are very closely related to pamirensis.

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* L. tibetanus centrasiaticus Satun. shows gradual transitions to the Turkestan desert hare L. t. lehmanni Severtz.

A detailed systematic analysis of Central Asian hares is beyond the scope of this book. I have dealt briefly with this question to clarify the relationship between these hares and those in the territory of the U.S.S.R.

GEOGRAPHICAL DISTRIBUTION of the desert hare and its seven subspecies.

The northern boundary of its range begins from the Buzachi Peninsula on the northeastern coast of the Caspian Sea. From there it crosses Ust-Urt and continues to the northwestern shore of the Aral Sea. We have no exact information as to whether it reaches the lower Emba river, though this is very probable.

A.M. Kolosov informed me that among a large number of Caspian common hares, 100 km from the estuary of the Emba river, he had seen a very small, long-legged, light colored hare in the summer of 1934, which differed clearly from the common hares and was possibly a desert hare.

The range of the desert hare then apparently crosses the Kara-Kum, Sary-Su deserts, the Golodnaya Step' (Bet-Pak-Dala), and extends to Lake Balkhash. It is not known where the northern boundary of the range passes north of Lake Balkhash. The boundary then continues to Lake Zaisan and to the Zaisan Depression, and reaches the Chuya Steppe on the Lesser Altai. It certainly occurs in Dzungaria. However, the northern and eastern boundaries of the range in Dzungaria cannot be exactly determined. It occurs on the Tien-Shan but it is not known how far to the east.

The eastern boundary of the range of the true desert hare also includes Kashgar. In eastern Turkestan (along the Yarkand-Darya) a different
184 species occurs, Lepus jarkandensis. The boundary then turns southward and includes the whole Pamir, Kashmir, the upper reaches of the Indus (Ngari), Afghanistan, Baluchistan, Iran (south to Lazistan, Khuzistan and Farsistan). It is not known how far west the range of the desert hare extends in this region, but it certainly occurs in northeast Iran (Khorasan, Iraq-i-Ajam)*. L. e. cyrensis Satun. occurs in Azerbaidzhan.

The desert hare was observed in the Buzachi Peninsula by A. Ostrovskii (1889); it was recorded from Ust-Urt by I. Brandt (1852) and by Eversmann (1850). Eversmann writes that the desert hare also occurs in the steppes near the Aral Sea. It is very common in the former Syr-Darya region (N.A. Zarudnyi, 1915). Large numbers occur near Kara-Kemken (N.M. Dukel'skaya), and near Kzyl-Orda (S.P. Naumov, 1927). N.A. Severtsov (1873) points out that it is common on the Kara-Tau, the Ili, along the Syr-Darya, as far as the Aral Sea and the eastern coast of the Caspian Sea.

According to M.N. Bogdanov (1882) it is especially numerous in Haloxylon shrubs along the Yany-Darya. The data of A.N. Nikol'skii (1887) show that it is very common on sandy ground along the southern shore of Lake Balkhash and along the river Lepsa. It is very numerous along the Ili river near the village Ili.

It occurs in the Zaisan Depression from where K.A. Satunin described a new species, L. zaisanicus, from near Lake Zaisan. Specimens collected there by G.I. Polyakov's expedition are in my collection. It occurs in the Chuya Steppe (Chegan-Burgazy, Kosh-Agach). According to V.N. Shnitnikov (1932) it is distributed throughout Dzhetysu [Semireche] at an altitude of 300-3000 m. The distribution of the desert hare in Dzhetysu seems sporadic. In some regions, e.g., the Trans-Ili Ala-Tau Mountains (near Alma-Ata), it disappeared after 1933. In other localities, e.g., along the Chilik river, it is common. N.A. Severtsov (1873) remarks that the desert hare is distributed on the Tien-Shan to an altitude of 10,000 feet and is numerous in the valley of the Chilik river and its tributaries, north of Issyk-Kul, on the Soktyube Mountain Pass, the Nyr-Dzhal river, on the Alexander Range, and near Merke. It was found on the Alexander Range in 1935, by the expedition of A.A. Mashkovtsev. D.N. Kashkarov (1932) writes that the desert hare occurs in large numbers on the sands of the Terskei-Ala-Tau, in the valley of the Sarychat river.

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* R. E. Cheesman (Report on a Collection of Mammals made by J. Hotson in Shiraz, Persia, Journal of the Bombay Natur. Hist. Soc., 1921) considers hares from Shiraz as Lepus lehmanni Sev.

According to S.N. Alferaki (1891) it is very numerous near Kuldja and common on the Pamir. M.P. Rozanov (1935) writes that the Tolai hare (i.e., the desert hare) occurred in large numbers when the expedition crossed the Trans-Alai Range (through the Kyzyl-Art Mountain Pass and the Markan-Su landmark area).

The desert hare is widely distributed in Tadzhikistan in Turkmenia where it was found by P. Varentsov (1894) in the Tedzhen District, and in the Areshsk District from the railway station at Dushak to the village of Mean. According to Radde, Walter, Blasius (1890) it is found from Krasnovodsk, Mikhailodo, Chikishlyar to the Amu-Darya (where it occurs on a large island near Chardzhou). These authors also observed it near the Afghan boundary, on the Atrek and Chandyr. According to S.I.
185 Bil'ketvich (1918) it is found near Repetek, Kizil-Bai, Tedzhen, and especially numerous in the Kara-Kum sands. I saw it on the Kopet-Dagh, on the Bolshie Balkhany Range and in the adjacent deserts.

It is apparently widely distributed in Iran (Thomas, 1905), south to Baluchistan (W. Blanford, 1875, 1876), and also throughout Afghanistan, though we have no exact data on its distribution in this country. It occurs in Kashgar (Dzhigda, Altum-Artush District, vide W.T. Blanford, 1879). It is found from northern Kashmir to the upper reaches of the Indus, in Ngari (W.T. Blanford, 1879, 1888).

MODE OF LIFE. The typical biotopes of the desert hare are desert and steppe, especially those adjacent to river valleys with tugais*. It is also found in deserts among sand dunes overgrown with Halozylon, Peganum harmala L., and Aristida pennata, and in semideserts with tamarisks. It avoids open clay desert overgrown with Artemisia and Salsola.

The desert hare is very common in river valleys and in depressions of lakes with thickets of shrubs. Thus, it occurs in large numbers in the lower reaches of the Talas river valley, along tugais of the Syr-Darya where Peganum grows occasionally, in thickets of Lasiagrostis and Hippophae rhaninoides, along the shore of Lake Issyk-Kul or in thickets of Nitraria, on saline soil along the outflow from the Buam Ravine into the lake, in tamarisk shrubs in the lower reaches of the Sary-Su, and in tamarisk thickets in the vicinity of Lake Baili-Kul (D.N. Kashkarov, 1932).

Foothills, high mountains and the subalpine belt (to about 3500-4000 m) are also included in the large range of the desert hare.

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* [Tugai — floodland forest in river valleys.]

According to M. P. Rozanov (1935) the desert hare lives on the eastern Pamir in summer, on moraines and on slopes among screes, and in thickets of Eurotia and Artemisia.

These plants are the main food of the hare in this region. The Pamir hare avoids humid meadows and rocks. Towards winter, according to local inhabitants, the hares descend in large numbers into the river valleys. This shows that the mountain hares make true seasonal vertical migrations. M. P. Rozanov (1935) recorded the hare from the pebbly bed of the Pyandzh river in the western Pamir. It lies here among sand dunes in thickets of Hippophae and tamarisk, and also on the dry, stony slopes.

W. G. Heptner (1933) writes: "Many hares are found near villages, where the banks of the irrigation canals are covered with grass and shrubs. These canals cross the cultivated areas, dividing them into small squares of corn, cotton, and melon fields. Rows of poplars grow along the roads and between the plots. The houses are surrounded by fruit orchards. The cemeteries, which are usually near the village, are overgrown with weeds and trees. When there is plenty of water, small 186 forests are often planted. Hares are occasionally very numerous and cause considerable damage to agriculture. They gnaw young wheat sprouts and leaves of cotton. They are especially harmful to melons and watermelons."

The desert hare is a rather timid animal in many places; in Turkmenia they ran away to the distance of a long shot when frightened. In places where hares are not used to the presence of man, they are confident and careless. They run rapidly and lightly. Their legs are well built and long. Their ears are rather long (Figures 93-98).

They are very active at dusk, but in some places also during the day. S. N. Alferaki (1891) writes that the desert hares seen by him near Kuldja are completely diurnal.

We have no exact data on the reproduction or food of the desert hare.

In Central Asia, the desert hare is scarcely hunted by man as its hide is of little value and it has not much meat.

The desert hare is preyed upon by: Vulpes corsac, desert foxes, wolves, polecats, and various cats, and also by the following birds of prey: golden eagle, steppe eagle. Young hares are probably caught by buzzards.

Subspecies of the desert hare

334. Lepus (Eulagus) tibetanus lehmanni Severtzov (1873). Syr-Darya desert hare

1852. Lepus tolai Brandt J. F., Zoologischer Anhang zu A. Lehmanns Reise nach Buchara und Samarkand, S. 308-309.

1861. Lepus aralensis Severtsov N. A., Zveri Priural'skogo kraya. Akklimatizatsiya (Animals of the Ural Territory. Acclimatization) II (2):49:70 (Nomen nudum!).

1873. Lepus lehmanni Severtsov N. A., Vertikal'noe i gorizontal'noe raspredelenie Turkestanskikh zhivotnykh (Vertical and Horizontal Distribution of Turkestan Animals), Izvestiya Obshchestva lyubitelei estestvoznaniya, VIII (2):62, 83-84.

1882. Lepus butlerovi Bogdanov M. N., Ocherki prirody Khivinskogo oazisa (A Survey of the Nature of the Khiva Oasis), p. 68 (Nomen nudum!) (Tugais along the Amu-Darya).

1882. Lepus kessleri Bogdanov M. N., op. cit., p. 68 (Nomen nudum!) (Tugais along the Amu-Darya)

1922. Lepus tolai lehmanni Ognev S. I., Materialy po sistematike russkikh zaitsev (Material on the Systematics of Russian Hares), Ezhegodnik zoologicheskogo muzeya Akademii Nauk, Vol. XXIII, p. 482.

1927. Lepus tolai subsp. Kashkarov D. N., Rezul'taty ekspeditsii v raione ozera Sary-Chilek (Results of an Expedition to the Lake Sary-Chilek Region), p. 101.

1929. L[epus] tibetanus lehmanni Ognev S. I. Zur Systematik der russischen Hasen, Zoologischer Anzeiger, Bd., 84, H. 1/4. S. 78.

TYPE LOCALITY AND DEPOSITION. Lower reaches of Syr-Darya river. It is not known whether the type is preserved.

MATERIAL EXAMINED: 24 pelts with skulls.

DIAGNOSIS. Back pale, straw-gray (intermediate between avellaneous
187 and drab). Ground color with blackish mottling weak in summer fur but well marked in winter fur due to long black hair and also to hair with gray-black bases. broad whitish subapical bands and black tips. Lower part of back in both summer and winter fur more ash-gray than rest of back, without a straw tinge.

Top of head whitish gray or whitish straw with marked black-brown mottling due to hairs with black-brown tips, broad black-brown bases and subapical medium whitish or straw-whitish bands.

Color of neck between pale yellowish straw (intermediate between pinkish buff and avellaneous), and reddish brown-gray (avellaneous with a reddish rust tinge). Color of neck in winter fur usually richer than that in summer fur.

Chest grayish rust-straw, intermediate between light vinaceous-buff and light pinkish cinnamon.

Color of anterior inner side of ears pale grav with a straw tinge, mixed with light blackish brown mottling in summer fur, darker in winter specimens. A broad white stripe along the outer fringe of the inner margin of the ears. Outer side of ears whitish, occasionally whitish gray with a slight straw tinge. Brown-black tips of ears narrow, poorly developed but better developed on the outside.

Anterior side of legs very pale, rust-straw-colored.

Length of skull 83-88.2 mm (M. 85.6 mm); zygomatic width 38.5-42.8 mm (M. 41 mm); length of nasals 34.2-38 mm (M. 36.6 mm); width of nasals 14-16 mm (M. 15.7 mm).

Length of body with head 387-485 mm (M. 455.9 mm); hind feet 108-126 mm; tail 75-107 mm (M. 97.8 mm); ears (measured along concavity) 87-100 mm, ear (measured from occiput) 100-126 mm (M. 119.8 mm).

ADDITIONAL DESCRIPTION. The above description shows that the color of the winter fur does not differ much from that of the summer fur. Color of back of summer fur with light blackish brown mottling. The color of the back of summer specimens is therefore lighter and sandier than in winter fur. Color of chest also somewhat paler, though this is not constant. Inner margins of ears of winter specimens have more blackish hair than in summer specimens.

Winter fur easily distinguished from summer fur by its markedly longer, softer and silkier hair.

COLORATION OF YOUNG. Generally paler, grayer and more whitish than in adults.

Color of back straw-gray-white with a light blackish brown mottling. Top of head whitish straw with brownish or blackish mottling. Neck very pale, straw-pink (vinaceous-buff). Flanks and lower part of back whitish gray. Chest very dull yellowish straw color. Color of anterior sides of legs richer and yellower. Inner sides of ears pale straw-yellowish gray. Outer fringe of inner margin of ears whitish. Inner side of ears
188 very pale, whitish straw. Anterior side of ears straw-whitish gray; outer side of tip of ear with a distinct narrow black-brown terminal fringe.

SYSTEMATIC NOTES. The relationships between Turkestan desert hares are not clear.

N.A. Severtsov ("Zveri Priural'skogo kraya" (Animals of the Ural Territory), 1861) states that a peculiar hare, Lepus aralensis (description not given), occurs in the lower reaches of the Emba and further south towards the Aral Sea. Severtsov (1873) described in detail the Turkestan desert hare under the name Lepus lehmanni. The holotype was a specimen obtained by Lehman in the lower reaches of the Syr-Darya. I do not know whether this holotype is preserved. M.N. Bogdanov (1882) recorded from the "Tugais along the Amu-Darya" two "species" of hares, Lepus kessleri and L. butlerowi, and gave their Russian common names, "long-eared" and "roan" hares. Bogdanov does not give any description, but on p.68 gives a poor drawing of Lepus kessleri. I had the opportunity of examining the stuffed types of these hares in the collection of the Zoological Museum of the Leningrad University. The animals are badly preserved, but they hardly differ from L.t.lehmanni.

W.G. Heptner* (1934) described a subspecies of the common hare, Lepus europaeus turcomanus. Heptner took as holotype a pelt and a skull of a hare obtained by S. Naumov and N. Lavrov near the well of Ak-Kuyu, 60 km north of Dzhebel (Transcaspia). Hares from the Kopet-Dagh which were determined as Lepus tolai craspedotis Blanf.** belong to the same subspecies, in Heptner's opinion (S.I. Ognev and W.G. Heptner, 1929).

Although neither I nor Heptner had a specimen of the true Baluchistan Lepus craspedotis, Heptner was probably correct in thinking that the Kopet-Dagh hare is different from L. craspedotis.

I doubt whether turcomanus can be considered as a subspecies of europaeus (see above). The Turkestan hares apparently belong to L. tibetanus, and not to L. europaeus.

The systematic position of L.t.turcomanus is not clear. W.G. Heptner only gives the following diagnosis "...Steht Lepus europaeus lehmanni Sev. nahe, unterscheidet sich aber, wie im Winter-, so auch im Sommerfell durch dunklere Färbung mit einem dunkel schwarzbraunen Anhauch, durch etwas kürzeres und grobhariges Fell und dunklere Färbung der vorderen inneren Seite der Ohren...". W.G. Heptner described Lepus europaeus turcomanus from two specimens of winter fur obtained in early March 1932. I have compared these hares with Aral winter specimens of L.t. lehmanni and could not find any differences. The
189 inner margin of the ears is grayish straw with weak brownish black mottling in both specimens from Ak-Kuyu. The inner margin of the ear of the holotype (No. 6342) is especially light. Heptner's diagnosis therefore does not agree with this holotype.

In Heptner's opinion, the hares from Ak-Kuyu are identical with hares from the Kopet-Dagh, and also with hares from the Bol'shie Balkhany Range. We doubt whether this is correct. The inner side of the ears shows marked darkening in the summer fur of Kopet-Dagh hares. On the other hand, the

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[*] W.G. Heptner, Systematische und tiergeographische Notizen über einige russische Säuger, Folia Zoologica et Hydrobiologica, Bd. VI, 1934, S. 21-23.

[**] S.I. Ognev and W.G. Heptner, "Mlekopitayushchie srednego Kopet-Daga i prilezhashchei ravniny" (Mammals of Central Kopet-Dagh and the Adjacent Plain). —Trudy Nauchno-issledovatel'skogo instituta zoologii, III (1): 71-73. 1929.

summer fur of the desert hares (e.g., L. t. lehmanni) is lighter than their winter fur. The inner side of the ears particularly is of lighter color. The winter Kopet-Dagh specimens are probably even darker and differ more sharply from both L. t. turcomanus and L. t. lehmanni.

The taxonomic position of L. t. turcomanus is doubtful. Its color differs little from that of L. t. lehmanni. Considering L. t. turcomanus as a synonym of L. t. lehmanni is a simple solution to this question. There is, however, a difficulty — the skull of L. t. turcomanus is small, and differs clearly from the more northern, L. t. lehmanni from the Aral Sea in its small measurements*, and narrower rostrum.

It is left open for the present whether L. t. turcomanus should be considered as a subspecies closely related to L. t. lehmanni, or as a natio of it, or whether it should be considered as a synonym of L. t. lehmanni.

GEOGRAPHICAL DISTRIBUTION. The Syr-Darya desert hare is widely distributed throughout Turkestan. In the west it enters the Ust-Urt Plateau and apparently occurs as far as the lower reaches of the Emba river. It also occurs along the northeastern shore of the Aral Sea along the Syr-Darya, in the Golodnaya Step', in the Kyzyl-Kum Desert, on the Kara-Tau, Alexander Range and on the Talas Ala-Tau. In the east, it is sporadically distributed throughout the Dzhetysu [Semireche] plain** to the mountains. A specimen from the vicinity of the village Rybach'ii on Lake Issyk-Kul is in my collection. Hares caught in the Zaisan Depression and near Dzharkent [Panfilov] belong to the same subspecies (natio zaisanicus). The eastern range of L. t. lehmanni apparently includes the northwestern part of Dzungaria. In Turkestan it occurs near Tashkent, Fergana, along the upper reaches of the Amu-Darya, in Khiva Oasis, and in the northern Kara-Kum Desert. Hares from north of Dzhebel are closely related to L. t. lehmanni but their skulls show some differences and they apparently belong to a separate natio.

This survey shows that the southern boundary of the range of L. t. lehmanni can not be exactly determined for lack of material and records.

190 334'. **Lepus (Eulagus) tibetanus lehmanni natio zaisanicus Satun. (1907). Zaisan desert hare**

1907. Lepus zaisanicus Satunin K., Ueber die Hasen Centralasiens, Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XI (1906), 1907, pp. 7-8.

1922. Lepus tolai zaisanicus Ognev S. I., Materialy po sistematike russkikh zaitsev (Materials on Taxonomy of Russian Hares), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXIII, pp. 483-484.

TYPE LOCALITY AND DEPOSITION. Vicinity of Zaisan (male Jan. 1891, collected by Pevtsov). Type in the ZMAN collection.

MATERIAL EXAMINED: 14 specimens.

DIAGNOSIS. Closely related to L. t. lehmanni Sev., but differing from it by its large skull. The following skull characters are observed in series: 1) very long incisive foramina; 2) bullae osseae more widely separate ventrally; 3) nasal bones longer.

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* See table of measurements.

** I have seen a specimen from Alma-Ata.

Color of summer fur grayer and duller than in L. t. lehmanni. However, there are specimens of both forms which are indistinguishable. Color of winter fur of L. t. lehmanni natio zaisanicus more whitish than that of L. t. lehmanni.

Length of skull 83.8-90 mm; zygomatic width 40-43.7 mm; length of nasals 34.1-41.7 mm; width of nasals 15-20.3 mm.

Length of body and head 443-490 mm; hind feet 120-128 mm; ear (measured along concavity) 83-113 mm; tail 88-116 mm.

SYSTEMATIC NOTES. As this hare is closely related to L. t. lehmanni, I intended to make zaisanicus a synonym of lehmanni. However, a careful examination of the skull showed that there are some differences between the Aral and Zaisan desert hares. The color characters are of so little importance that they can be ignored. Therefore, until more material becomes available I suggest considering zaisanicus as a natio of lehmanni.

I have noticed that specimens of this subspecies become larger towards the north, and smaller towards the south. For instance, the cranial differences between zaisanicus and hares from Ak-Kuyu (north of Dzhebel) described by W.G. Heptner as Lepus europaeus turcomanicus (see above) are much more marked than those between specimens from the northeastern shore of the Aral Sea and the Zaisan specimens.

If new material would confirm that the skull of L. t. turcomanicus is smaller than that of lehmanni, this form could be considered as a separate natio.

All these questions, can be solved only after examination of more material.

GEOGRAPHICAL DISTRIBUTION. This form is widely distributed in the Zaisan Depression. K.A. Satunin (1907) described what he thought to be a
191 new "species" from Zaisan (collected by N.V. Pevtsov's expedition), and also from Kendyrlik* (collected by Kolomeitsev). G.I. Polyakov (1909) obtained a small series of Zaisan hares on the banks of the Kara-Irtysh in the Zaisan Depression. A good series of Zaisan hares was collected by B.A. Kuznetsov near the village Kara-Bulak (former Semipalatinsk Region of the Zaisan District).

Specimens caught by P. Rohdendorf (1925) correspond in their skull structure to this natio. This apparently also occurs in Dzungaria, at least in its northwestern part.

335. Lepus (Eulagus) tibetanus quercerus Hollister (1912). Chuya hare

1912. Lepus quercerus Hollister N., Proceedings of the Biolog. Society of Washington, Vol. XXV. p. 181-184.

TYPE LOCALITY AND DEPOSITION. Chuya Steppe, No. 175446, male adult, 28 July 1912, N. Hollister. Type in the U.S. National Museum.

MATERIAL EXAMINED: 6 pelts and 3 skulls.

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* Kendyrlik lies east of Zaisan, near the frontier of the U.S.S.R.

DIAGNOSIS. General color of back straw colored (intermediate between pinkish-buff and avellaneous, plate XXIX and XL), strongly darkened by black or black-brown subapical bands of the hair; tips of hair pale straw colored.

Top of head straw colored (pinkish buff) with strong brown mottling which gives a dark appearance to the head. Color of neck pale straw with a dark pinkish tinge (light pinkish cinnamon). A straw-yellow (pinkish buff) stripe across the chest. Anterior-lateral parts of muzzle gray, cheeks either straw-yellow or ash-gray. Eye surrounded by a broad, whitish ring.

Color of anterior inner margin of ears varying. In one specimen it is gray with slight blackish brown mottling. In another specimen, the inner margin is pale pinkish straw (intermediate between pinkish buff and light pinkish cinnamon) and chestnut-brown outwards. The external fringe of the inner margin with a well marked whitish stripe. Posterior sides of ears whitish with a light straw tinge. Black-brown tips of ears narrow, poorly developed and better marked on the outside.

Flanks gray with a well marked straw tinge (pinkish buff). Anterior side of legs pale straw colored.

Length of skull 84.9-87.2 mm; zygomatic width 40.2-44 mm; length of nasals 36.7-38.1 mm; interorbital width 13.2-14.9 mm; length of upper molars 13-13.2 mm. N. Hollister gives the following measurements for the type: Length of skull 82 mm; zygomatic width 41.5 mm; length of nasals 34.2 mm; interorbital breadth 14.8 mm; length of upper row of molars 14.3 mm.

Measurements of specimens examined by us for comparison with those of Hollister:

192

	No. 82♀, Feb. 1936, Chegan-Burgazy	No. 57 ♂, 30 June 1936, Near Kosh-Agach	♂ ad., 2 July 1912 According to Hollister
	Length (in mm.)		
Body	460	460	470
Tail	86	86	86
Hind foot	110	110	115
Ear	90	90	—
Weight (in grams)	2520	1980	—

ADDITIONAL DESCRIPTION AND SYSTEMATIC NOTES. A young hare obtained by A.M. Kolosov (11 July 1936) in Chegan-Burgazy, Chuya Alps (No. 150 male) has the following measurements: body length 95 mm [sic]; ear 84 mm. It has a pale gray-straw-yellow color on the back with a marked blackish brown tinge, caused by black-brown guard hair and black-brown tips of some guard hairs which have pale straw-white subapical bands. Color of back mottled.

Color of top of head similar to that of back. Occiput with a distinct white spot. Sides of muzzle whitish gray. Cheeks straw-gray. Eyes surrounded by a well marked white ring. Color of occiput pale, yellowish straw (pinkish buff, Ridgway, 1912). Flanks pale gray with a straw tinge. A dull straw-yellow (pinkish buff) stripe across the chest. Anterior inner margin of ears dull gray-straw-yellow. A straw-white fringe on the outer side of the inner margin of the ears. Posterior sides of ears straw-white which is better marked on the proximal parts of the outside of the ears. Brown-black tips well marked on the posterior side.

Color of young (body length 250 mm, weight 150 grams) as follows: back pale straw-gray-yellow with weak blackish brown mottling. Color of top of head like that of back. Vertex with a well marked oblong white spot. Anterior-lateral parts of muzzle pale gray. Cheeks more ash-gray. Eye surrounded by a broad white ring. Flanks pale gray with a light straw tinge. A dull straw-gray stripe across the chest. Anterior inner parts of ears straw colored with strong blackish brown mottling. Tip of inner side of ears with well developed straw tones (pinkish buff) giving the tips a very marked color. Posterior side of ears whitish. Tip of ears on the posterior side with a narrow blackish fringe.

N. Hollister (1912) gives the following description of the type of Lepus quercerus: "General color of dorsum straw-yellow (pinkish buff) with a black and well marked vinaceous-straw tinge (vinaceous-buff). Sides of muzzle and bases of ears gray. Anterior inner part of ears pale isabella color. Tip of anterior inner part of ear straw colored. Posterior 193 side of ears almost white. Inner parts white. A black-brown stripe along two-thirds of the inner side of the ears. Fringe of inner side straw colored (buff). Tips of ears blackish, color descending 15 mm along the posterior side of the ear, forming also a narrow margin along the anterior inner side. Occiput brownish ocher (clay color). Hindquarters grayer than back with well developed straw and vinaceous-straw tone. Tail white with greater part of dorsal side black. External side of legs pale, rust-straw colored (pale cinnamon). Stripe across chest brownish ocher. Remaining underparts including inner sides of legs white."

Hollister's description agrees well with the Chuya specimens obtained in 1936 by A.M. Kolosov.

There are some differences between the Chuya hares and the Zaisan and Semipalatinsk specimens (natio zaisanicus). Back of Chuya hares blacker. Straw tone on flanks more marked. Ash-gray tones marked on the anterior-lateral part of the muzzle. Whitish ring around eyes more marked. According to Hollister, the ears of Lepus quercerus are longer than those of zaisanicus. However, he does not mention the length of the ears of his new species. We did not find any differences between our specimens and the Zaisan-Semipalatinsk specimens in this respect or in skull structure. General appearance and structure of skull is subject to individual variations in Central Asian hares.

The material at our disposal is insufficient to determine the systematic position of the Chuya hare exactly. Furthermore, the adults obtained by A.M. Kolosov from the Chuya Steppe had not finished their molt in spite of the late date (June-July). Their fur does not, therefore, consist completely of fresh summer hair. It is thus difficult to use this material for systematic purposes.

L. quercerus (a subspecies of tibetanus) is thus apparently distinguishable from zaisanicus in some color characters but their constancy and distinctness should be verified on a large series.

336. Lepus (Eulagus) tibetanus subsp. Kopet-Dagh desert hare

1928. Lepus tolai craspedotis Ognev S.I. and Heptner W.G., Zoologischer Anzeiger, LXXV, S. 261; Ognev S.I. and Heptner W.G., Mlekopitayushchie srednego Kopet-Daga i prilezhashchei ravniny (Mammals of the Central Kopet-Dagh and the Adjacent Plains), Trudy Nauchno-issledovatel'skogo instituta zoologii, III (1): 71-73. 1929.

1934. Lepus europaeus turcomanus (partim!) W. G. Heptner, System. und tiergeogr. Notizen über Säugetiere. Folia Zoologica et Hydrobiologica, Riga, Vol. VI, No. 1, S. 21-23.

TYPE LOCALITY. No. M. 3064 male, 9 June 1925, near the village Verkhneskobelevskii, Kopet-Dagh, Transcaspia. S. I. Ognev's collection. No. M. 3065 male, 17 August, 1925, near the village Sulyukli, Kopet-Dagh, S. I. Ognev's collection.

MATERIAL EXAMINED: 2 further pelts from the Kopet-Dagh and Bol'shie Balkhany Range. Total 4. specimens.

194 DIAGNOSIS. General color of back of summer fur straw-gray with a well marked dark mottling which gives a gray tinge to the general color of the back. Lower part of back grayer. Flanks with marked dull straw-brown tones intermediate between avellaneous and wood-brown.

Top of head straw-gray, sometimes with well marked blackish mottling. Neck dull, straw-brown (intermediate between avellaneous and wood-brown).

Chest dull straw-gray with a light reddish tinge (close to avellaneous).

Color of anterior inner margin of ears straw-gray with well marked blackish mottling which gives the general impression of blackness. A white marginal stripe along the outer fringe of the inner side. Posterior side of ears whitish with an admixture of blackish hair. Black-brown tip of posterior apical part of ears well developed. Anterior side of legs straw-gray.

Length of skull 84-86 mm; zygomatic width 38-42 mm; length of nasals 36-37 mm; width of nasals 15-16 mm.

Length of body and head 435-460 mm; hind feet 121 mm; ear (measured along concavity) 108-119 mm; ears (measured from occiput) 139-149 mm; tail 75-87 mm.

SYSTEMATIC NOTES. The Kopet-Dagh hares resemble L. t. lehmanni closely in their color. They differ from it as follows: 1) grayer tone on the back; 2) duller color of chest; 3) black anterior inner margin of the ears.

The skull of the Kopet-Dagh hares is smaller than that of L. t. lehmanni in the small material examined. Rows of molars especially small and weakly developed. Length of upper row of molars 14-14.9 mm in our specimens, in L. t. lehmanni 15-16.9 mm.

W. G. Heptner and myself (1929) provisionally identified the Kopet-Dagh hares as L. t. craspedotis which was described by Blanford ("Annals and Magazine of Natural History", 1875, ser. 4, p. 313 and in "Eastern Persia", II, Zoology, 1876, pp. 80-82, p. VIII) from Baluchistan (Pishin).

The Kopet-Dagh hares are certainly closely related to Baluchistan hares in some characters, e.g., the general gray color, black color on the ears, length of ears, etc.

However, the Baluchistan hares are even darker than the Kopet-Dagh hares. Blanford unfortunately does not mention the date of collection of his holotype. He possibly used a specimen in winter fur, which is darker and blacker. However, the far removed range of L. t. craspedotis makes it doubtful whether this hare is identical with the Kopet-Dagh hare.

The relation of the Kopet-Dagh hare to L. europaeus turcomanicus Heptner has been discussed above.

GEOGRAPHICAL DISTRIBUTION. The Kopet-Dagh hare is apparently
195 restricted to the foothills and mountains, and does not occur in the plains. During the Transcaspian expedition (1925) we caught the first specimen in tamarisk thickets near the village Verkhneskobelevskii. However, hares were rather rare in this region. Near Germab they are more common.

In the mountains near the village Sulyukli (altitude 5000-6000 feet) they are very abundant in some years. They keep mainly to screes and juniper thickets in this region. S.I. Bil'kevich obtained them in the Bol'shie Balkhany Range in juniper forest, i.e., rather high in the mountains.

337. Lepus (Eulagus) tibetanus desertorum Ogn. et Heptner (1928). Desert sand hare

1886. Lepus lehmanni Niko'skii A.M., Materialy k poznaniyu fauny pozvonochnykh severo-vostochnoi Persii i Zakaspiiskoi oblasti (Data on the Vertebrate Fauna of Northeastern Persia and Transcaspia), Trudy Sankt-Peterburgskogo obshchestva estestvoispytatelei, p. 7.

1890. Lepus lehmanni Radde, G., Walter, A., Blasius, W., Die Säugethiere Transcasp., Tiflis, pp. 62-64.

1894. Lepus lehmanni Varentsov P., Fauna Zakaspiiskoi oblasti (Fauna of Transcaspia), p. 16, 17.

1918. Lepus lehmanni Bil'kevich S.I., Kollektsiya Zakaspiiskogo muzeya (The Collection of the Transcaspian Museum), Izvestiya Zakaspiiskogo muzeya, I, p. 9.

1928. Lepus tolai desertorum Ognev S.I. und Heptner W.G., Einige Mitteilungen über die Säugethiere des mittl. Kopet-Dagh etc., Zoologisch. Anzeiger, LXXV, S. 262. Ognev S.I. and Heptner W.G., Mlekopitayushchie srednego Kopet-Daga i prilezhashchei ravniny (Mammals of the Central Kopet-Dagh and the Adjacent Plain), Trudy Nauchno-Issledovatel'skogo instituta zoologii, III(1):73-75.

1934. Lepus europaeus desertorum Heptner W.G., Systemat. und tiergeogr. Notizen über Säugethiere Folia Zoologica et Hydrobiol., Vol. VI, No. 1, S. 22-23.

TYPE LOCALITY AND DEPOSITION. M. 3066, female, 2 May 1925, near railway station Annau, Transcaspia. S.I. Ognev's collection.

MATERIAL EXAMINED: 9 pelts and skulls.

DIAGNOSIS. Differing from L. t. lehmanni in its very pale straw-sand color of the summer fur with a few blackish hairs. Winter fur on back with distinct, irregular blackish mottling on a light straw-yellow background. Summer specimens markedly lighter and not as gray as specimens caught in winter.

Length of skull 76.6-84 mm; zygomatic width 37-40.7 mm; length of nasals 31.8-37.5 mm; width of nasals 15.6-18.5 mm.

Length of body and head 399-460 mm (M. 431.3 mm); hind paws 102-120 mm (M. 118 mm); ear (measured along concavity) 98.2-105 mm; ear (measured from occiput) about 120 mm or more; tail 79-100 mm.

These measurements show that the skull of L. t. desertorum is smaller than that of L. t. lehmanni.

ADDITIONAL DESCRIPTION. General color of summer fur on back very pale straw-sand colored with a light reddish vinaceous tinge (intermediate between avellaneous and vinaceous-buff).

Blackish mottling on back little marked as there is little long black guard hair and the blackish hair tips are also little developed. Roots of guard hair grayish, followed by broad straw-sand colored bands and short blackish brown tips.

196 Top of head very pale, straw-sand colored. Muzzle with a whitish tinge. Eyes surrounded by a whitish ring. Color of neck pale straw-pink (vinaceous-buff).

Color of chest very pale, straw-yellow (intermediate between pale pinkish buff and pinkish buff).

Color of anterior inner margin of ears pale, straw-yellow (intermediate between vinaceous-buff and pinkish buff), without any marked black or gray color, because of the almost complete absence of blackish hair. Outer side of inner margin of ears with a broad white fringe. Inner side of ears whitish, with relatively few hairs and the skin clearly visible. Posterior sides of ears light whitish straw-gray.

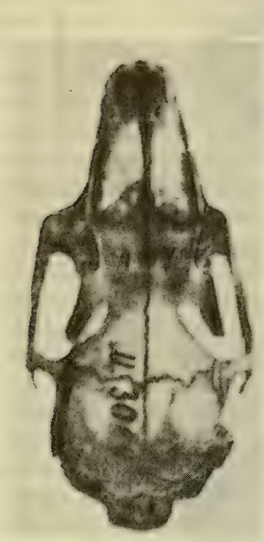

FIGURE 102. Skull of Lepus tibetanus desertorum Ogn. M. 3066, from Annau (near Ashkhabad), holotype, S. I. Ognev's collection

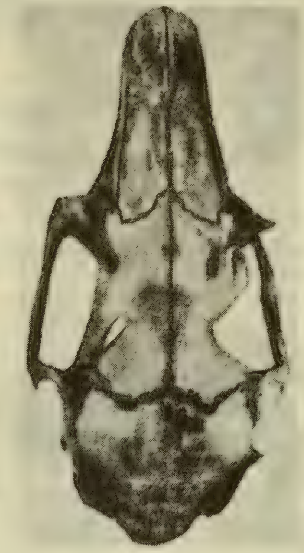

FIGURE 103. Skull of Lepus tibetanus buchariensis Ogn. M. 3660, 22 May 1914, Khatyn-Rabad, N. A. Pobrinskii, S. I. Ognev's collection

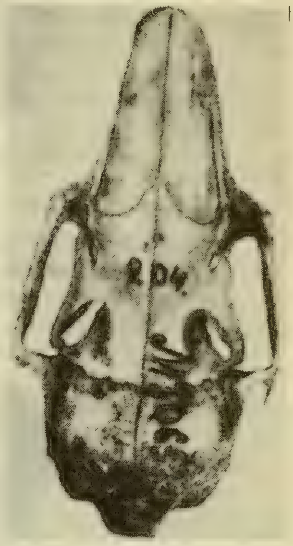

FIGURE 104. Skull of Lepus tibetanus subsp., No. M. 3065, Sulyukli, Kopet-Dagh, S. I. Ognev's collection

197 Anterior side of legs very pale, straw-yellow.

Belly and groin white. Tail white, with black dorsal side.

The winter fur differs rather sharply from the summer fur. Its hair is much longer and fluffier than in summer fur. Blackish parts of hairs broader and more distinctly marked. This gives a rich color and a characteristic variegation. Rust tones on occiput and chest well marked. Color of occiput intermediate between avellaneous and pinkish cinnamon. Color of chest duller.

General color of winter fur variable. There are specimens with more yellowish fur, or with fur of a more pale gray color.

SYSTEMATIC NOTES. The desert sand hare differs clearly in series from L. t. lehmanni in its generally pale color. These differences are very distinct in series of summer and winter specimens.

GEOGRAPHICAL DISTRIBUTION. I shot the first specimen of this subspecies in a semidesert with stunted vegetation near the railway station at Annau (Transcaspia). I also examined pelts and skulls from near Geok-Tepe, near the railway station at Sary-Yazy, near Chatlov (on the Atrek), near Uch-Adzhi, near Chelayun 35 km east of Gasan-Kuli, and near Karabat.

The distribution of L. t. desertorum thus includes the southern desert and the sand dunes of Transcaspia (from the southeastern corner of the Caspian Sea to the Amu-Darya, to about Chardzhou). The range thus includes the southern Kara-Kum desert.

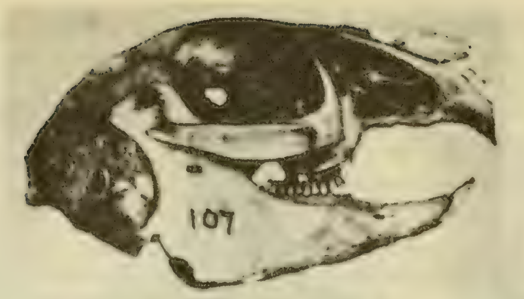

FIGURE 105. Skull of Lepus tibetanus desertorum Ogn. No. M. 3066, Annau, near Ashkhabad

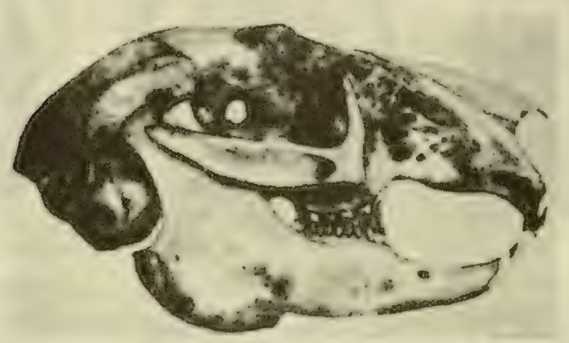

FIGURE 106. Skull of Lepus tibetanus buchariensis Ogn. M. 3060, holotype

197 338. Lepus (Eulagus) tibetanus buchariensis Ogn. (1922). Buchara desert hare

1823. Lepus tolai Lichtenstein H., Naturg. Anhang zu Eversmann's Reise nach Orenburg u. Buchara, S. 118.

1922. Lepus tolai buchariensis, Ognev S. I., Materialy po sistematike russkikh zaitsev (Data on the Systematics of Russian Hares), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXIII, p. 475.

1922. Lepus tolai buchariensis, Ognev S. I., Nekotorye dannye po sistematike russkikh zaitsev (Data on the Taxonomy of Russian Hares), Biologicheskie izvestiya, Vol. I, pp. 102-104.

TYPE LOCALITY AND DEPOSITION. Khatyn-Rabad, east of Termez. No. M. 3060 male, 22 May, 1914, N. A. Bobrinskii, type in S. I. Ognev's collection.

MATERIAL EXAMINED: 11 specimens.

DIAGNOSIS. Differs from L. t. desertorum in the distinct rust-red tinge of the pale sand-straw colored back. The longer and softer fur of winter specimens has a distinct brownish (a blackish brown) mottling. Reddish rust shades are also well marked on the ears of many specimens.

Length of skull 79-88.3 mm (M. 84 mm); zygomatic width 38.6-42.2 mm (M. 40.5 mm); length of nasals 32.2-41.7 mm (M. 36.6 mm); width of nasals 13.2-16 mm (M. 14.5 mm).

198 Length of body and head 460-530 mm (M. 485 mm); hind feet 102-119 mm (M. 112.7 mm); ears (measured from occiput 95-117 mm (M. 123 mm) [sic]; tail 78-120 mm (M. 109.1 mm).

ADDITIONAL DESCRIPTION. Summer fur. General color of back pale, sand-straw colored with a distinct rust-red tinge (intermediate between avellaneous and light pinkish cinnamon), with a small admixture of long, black guard hair which causes a grayish mottling. Color of ordinary guard hair: roots grayish, followed by pale rust-straw colored bands and brownish black tips. Color of underfur whitish with a rust-straw tinge. Color of top of head similar to that of back but its general color is sometimes paler and yellower. Color of anterior part of muzzle and cheeks pale straw with a light rust tinge. Eyes surrounded by a whitish ring.

Neck reddish rust-straw colored (intermediate between pinkish cinnamon and light pinkish cinnamon).

Chest of the same reddish rust-straw color, its color sharply different from that of the white chin, belly and middle part of groin. A pale rust-straw colored stripe on the sides of groin, extending to the inside of the hind legs. This stripe stands out clearly on the white background.

Similar rust-straw colored fur becomes straw-reddish rust colored (intermediate between light pinkish cinnamon and pinkish buff) on the flanks.

Color of anterior inner margin of ears pale straw-yellow with a light rust and grayish tinge. Outer fringe of inner margin of ears white, sometimes a little yellowish. Inner side of ears whitish. A distinct straw-rust tinge along the outer margin of the ears. Posterior side of ears whitish gray. Posterior apical margin of ears with a blackish terminal fringe.

Anterior side of legs straw-reddish rust colored.

Tail white. Color of the dorsal side blackish brown.

The winter fur has longer and softer hair than the summer fur, and the brownish and gray brownish mottling on the back is better developed. There are no marked differences between the color of summer and winter fur in this subspecies.

SYSTEMATIC NOTES. The coloration of L. t. buchariensis is rather constant, but there are variations both towards stronger development of rust-red shades, and towards more reddish and yellowish shades.

It differs from L. t. lehmanni in the following characters: 1) paler sand-straw-rust color of the back which is more grayish in L. t. lehmanni; this is especially marked in the winter fur; 2) color of neck in L. t. lehmanni duller and darker; 3) color of legs rich rust-straw colored; in L. t. lehmanni, the legs are pale gray; 4) color of ears in 199 L. t. buchariensis paler yellow than in L. t. lehmanni, with rust tones which are absent in L. t. lehmanni.

The range of the Bukharian subspecies is adjacent to that of L. t. desertorum.

GEOGRAPHICAL DISTRIBUTION. N.A. Bobrinskii's expedition obtained large numbers of this subspecies near the village Sardab-Buzachi, and near Khatyn-Rabad (east of Termez). L. t. buchariensis lives on sandy and on sand-clay-ground in tamarisk thickets. It is apparently widely distributed in Tadzhikistan, from where it enters northeastern Afghanistan.

339. Lepus (Eulagus) tibetanus pamirensis Blanford (1875). Pamir desert hare

1875. Lepus pamirensis Blanford W. T., Journal Asiatic Society of Bengal, XLIV, p. 110.
1879. Lepus pamirensis Blanford W. T., Scientific Results of the Second Jarkand Mission, Mammalia, pp. 67-68.
1879. Lepus sp. Severtsov N. A., Zametki o faune pozvonochnykh Pamira (Notes on the Vertebrate Fauna of the Pamir) Zapiski Turkestanskogo otdeleniya geograficheskogo obshchestva, I, p. 64.
1886. Lepus lehmanni Grum-Grzhimailo G. E., Ocherk Pripamirskikh stran (A Survey of the Countries Adjacent to the Pamir), Izdatel'stvo Geograficheskogo obshchestva, XXII, p. 92.
1935. Lepus tolai pamirensis Rozanov M. P., Materialy po mlekopitayushchim Pamira (Data on Mammals of the Pamir), Tadzhikskaya kompleksnaya ekspeditsiya 1932 goda, Issue XXXII, pp. 53-54.
TYPE LOCALITY. Lake Syry-Kul, Pamir. Deposition of type unknown.
MATERIAL EXAMINED: 6 pelts.

DIAGNOSIS. Differs clearly from the other subspecies of the desert hare in that its summer fur is very soft and delicate and its winter fur is even more so. General color of summer fur on back, pale straw-gray with a light vinaceous tinge (intermediate between reddish gray and vinaceous buff). Flanks yellowish white. Chest very pale straw-yellow. Inner margin of ears with a marked chestnut-brown tone which gives this part of the ear a dark appearance.

Winter fur with conspicuous grayish brown, sometimes blackish, mottling. Specimen No. S.5004, in the collection of the Moscow Zoological Museum, shows a marked black-brown color in the middle of the back, on head and ears.

Length of skull 83-89 mm; zygomatic width 40-41.4 mm; length of nasals 34.3-39.8 mm; width of nasals 14.2-16.3 mm.

ADDITIONAL DESCRIPTION. General color of summer fur on back pale straw-gray with a slight vinaceous tinge (intermediate between drab-gray and vinaceous-buff). Black hairs few in number, giving a grayish tinge.

Color of top of head resembling that of back, but grayer.

Anterior part of muzzle and cheeks with a whitish shade. Eyes surrounded by straw-white rings.

Occiput very dull, pale straw-rust colored, intermediate between light pinkish cinnamon and vinaceous-buff.

Chest very pale, straw-yellow (intermediate between pale pinkish buff and pinkish buff).

200 Flanks more whitish and lighter than back. Belly and groin white.

Color of anterior inner margin of ears chestnut-gray-brown (between hair-brown and benzo-brown). Fringe of inner margin whitish. Inner side of ears whitish gray. Posterior side of ears dirty-straw-white. Apical part with a brownish-black margin.

Anterior side of legs pale straw yellow.

Tail white, its dorsal side black.

Winter fur more luxuriant and dense. Brownish gray mottling distinct on the general straw-yellowish gray background.

There is an interesting specimen in the Moscow Zoological Museum caught on the Pamir by Voskoboinikov (1898) (No. S. 5004). The middle part of the back is deep black-brown, it has much black hair on top of the head, and only a straw-gray mottling on a general black-brown background. Flanks much lighter than back, straw-yellowish gray. Chest and neck pale, straw-rust colored. Belly and groin white.

Anterior inner margin of ears straw-gray with a strong admixture of black-brown hair. Outer fringe of anterior inner margins white, contrasting with the dark background.

Anterior side of feet pale straw-yellow.

Blanford (1879) describes L. pamirensis as follows: "General tone very pale, sandy-brown, almost isabella colored on back and flanks. Hindquarters grayish white. Dorsal side of tail black. Anterior side of ears of the same color as the back. Outer margin of distal parts of ears black. Chest light reddish brown (rufous). Venter usually white. Fur fine, dense and soft..."

It appears from this description that Blanford had specimens with light anterior inner margins of the ears. The dark color of these parts in our specimens cannot therefore be considered as a reliable and constant character.

SYSTEMATIC NOTES. This high-mountain form is characterized by its luxuriant and soft fur even in summer.

It differs clearly from other desert hares by the texture of its fur and some color characters.

As mentioned above, specimens of Lepus kaschgaricus Satun. from the Bol'shoi Yuldus and Tien-Shan (obtained by M.N. Przheval'skii) are closely related to the Pamir hare.

GEOGRAPHICAL DISTRIBUTION. According to N.A. Severtsov, this form is common on the Pamir. In G.E. Grum-Grzhimailo's opinion (1886) it is very common in this region. M.P. Rozanov (1935) writes that the Pamir expedition found large numbers of L. t. pamirensis in the Markansu area, beyond the Kyzyl-Art Pass in the Trans-Alai.

Subgenus **Lepus s. str.** Linnaeus (1758)

201 1904. Lepus (subgenus!) Lyon M., The Hares and their Allies, Smithson, Miscell. Collections, Vol. I, parts 3-4, p. 394 and 334 (partim!).

1902. Lepus (group) Barrett-Hamilton H., A History of British Mammals, p. 292.

Head relatively large. Ears short, 1 1/10 — 1 1/8 as long as head (measured from occiput).

Tail with terminal hair much shorter than hind foot.

Tail whitish gray in summer fur, markedly gray on the dorsal side. Tail completely white* in winter fur. Teats 8.

Winter fur sharply different from brownish gray summer fur in most forms**.

Species of this subgenus completely white in winter. Only the tips of the ears remain black. Nasals measured from anterior corner to posterior outer corner as long as, shorter than, or rarely longer than frontal suture.

Width of incisive foramina 1 1/8 to 1 1/4 as long as the bony palate. Anterior lower premolar slightly inclined backwards.

Geographical distribution. Boreal and arctic regions of Eurasia and North America †.

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* In arctic forms, tail completely white both in summer and winter.

** With the exception of Lepus hibernicus Pall.

† Small American hares of the group of Lepus americanus and its subspecies are often placed into the subgenus Lepus (e.g., H.E. Anthony, 1928). This is incorrect in our opinion. These hares differ clearly from true Lepus in cranial and morphological characters. American hares of the group americanus belong to a separate subgenus Poecilolagus Lyon.

160. Lepus timidus Linnaeus (1758). Blue hare

1758. Lepus timidus Linnaeus C., Systema Naturae, editio 10, p. 57.

NAMES: The mountain or blue hare (English); Nordischer Schneehase, Veränderlicher Hase (German); Le lièvre blanc ou le changeant (French).

LOCAL NAMES: ushkan (Russian in Siberia); zaets' bilyi or bilyak [white hare] (Ukrainian); numala (Mordvinian); Koetsch, or lotets (Votyak, Permyak); meran (Mari, Cheremis); molgach (Chuvash); Koetsch (Komi-Zyryan); nummel (Lapp, on the Imandra); njammel (eastern Lapland); shaur, or shogur (Khanty-Ostyak, on the Ob); toegur (in Surgut); kuyan (Bashkir, Meshchera); shichve, or sheching (Mansi Vogul); nevu or n'yava (Nenets along River Ob); neuko (along Pechora river); n'eva (Yurak); taivusi (Nenets along Taz river); nyaba (Nenets in the Turukhansk Territory); nyuma (Selkut, Ostyak in the Turukhansk Territory); teus' (Yurak); n'oa or nioa (on the Narym); n'omu (Nganasan, Tawgi); mundukan (Evenki, Tungus); kuobakh, kobak, dveleken, tavyskhan (Yakut); tuksaki (Evenki, in the Olekma-Vitim Territory); Chagechantu (Orochen); cholgoro (Odul, Yukagir); oiegon (tundra inhabitants, Odul-Yukagir); chyi, chyik (Nivkhi-Gilyak of the western Sakhalin Coast); ossik, or kanak (white) (Nivkhi-Gilyak of central and eastern Sakhalin); ossuki (Ainu on Sakhalin); toksa, or tochsa (Nanai, Goldi-Samagir); tochsa and golmochomg (Nanai, Goldi between Geong and Ussuri); gurmakho (in the region between Ussuri and Sungari); toksake (Birar, Manyagr, Orochen); milut (Nymyllan, Koryak), khalluk (Aleut); bilchuch (Kamchadal); melotal'gin (the first l pronounced softly; Chukchi).

PRINCIPAL FIGURES: 1) Pennant Thomas, Zoologia Britannica, IV, p. 40, pl. 47, 1770; 2) Schreber I., Die Säugethiere, Erlangen, Bd. IV, 1792, S. 885-891, Taf. CCXXXV A (summer fur); Taf. CCXXXV B
202 (winter fur); 3) Bingley W., Memoirs of British Quadrupeds, 1809, p. 308 (color plate); 4) Nilsson Sv., Illuminerade Figurer till Skandinav. Fauna, 1831-1832, Vol. I, H. 6, pl. 22 (Lepus borealis varietas - entire animal in color), H. 6-7, pl. 16, 19 (Lepus borealis - entire animal in winter and summer fur in color); 5) Simashko Yu., Russkaya fauna. II, Mlekopitayushchie (Russian Fauna. II. Mammals), 1851, pp. 785-787; pl. 60 A, figs. 2-3 (summer fur in color); pl. 61, fig. 2 (winter fur in color); pl. 61, fig. 3 (skull); pl. 62, fig. 3 (winter fur in color). Lepus variabilis in color: pl. 62, fig. 1 (Lepus canescens in color); 6) Middendorf A. Th., Über die als Bastarde Angesproch. Mittelformen zw. L. europaeus und. L. variabilis, Bullet, phys.-mathem. de l'Académ. Imp. de St.-Petersb., IX, No. 14, 1851, pp. 25-29 (drawing of skull, p. 29); 7) Blasius J., Naturgeschichte d. Säugethiere Deutschl., 1857, S. 420-425, Fig. 229 (structure of teeth and bony palate); 8) Meves W., Holmgren A. E., Atlas ofver Scandinaviens Däggdjur, Stockholm, 1873, pl. XV, Fig. 1-7 (Lepus timidus L. - canescens et borealis in color); 9) Brehm A., Zhizn' zhivotnykh. II (Animal Life, Vol. II), 1874, p. 252; 10) Nordquist O., Anteckninger och studier till Sibirska Ishafskustens Däggdjurs-Fauna, 1833, pp. 84-90, figs. 8-10 (skull ventral, dorsal and lateral); 11) Trouessart E. L., Histoire Naturelle de la France, Mammifères, Paris 1885, p. 187, fig. 78 (entire animal); 12) Fokht K., Mlekopitayushchee v opisaniyakh (Descriptions of Mammals), Moscow, 1885, p. 403 (half-tone plate of hare in winter fur); 13) Flower W. H., Lydekker R., An Introduct. to the Study of Mammals, 1891, p. 493, fig. 218 (entire animal); 14) Brehm A. E., Zhizn' zhivotnykh. II. (Animal Life, Vol. II), p. 664 (half-tone plate of entire animal); 15) Lydekker R., A Hand-Book of the Brit. Mammalia, London 1895, pl. XXVIII (entire animal in color); 16) Kashchenko N. F., Rezul'taty Altaiskoi ekspeditsii (Results of the Altai Expedition), Tomsk, 1899, pp. 57-59, pl. 11, fig. 4 (drawing of ears); 17) Forsyth Major, On Fossil and recent Lagomorpha, Transactions of the Linnean Society of London, Vol. VII, Zoology, 1896-1900, p. 468, fig. I-II (drawing of incisors, ventral); 18) Lyon M. W., Classification of Hares and their Allies, Smiths. Miscellaneous Collections, Vol. I, pp. 3-4, 1903 (1904). pl. LXXX and LXXXI, fig. 3 L. tschuktschorum (skull dorsal and ventral); fig. 4 L. variabilis - (skull); 19) Gake, V., Zhivotnyi mir (The Animal World), Vol. I, 1901, pl. 29 (color plate); 20) Millais J. G., The Mammals of Great Britain, Vol. III, 1906, pl. 50 (color), pl. 51 (color), pl. p. 32 (biological scene), pl. p. 34; 21) Hilzheimer M., Die Hasenarten Europas, Jahreshefte d. Vereins für vaterd. Naturk. im Württ., 1908, S. 385-387, Taf. V., Fig. 8a-c (skull, mandible, teeth); 22) Meerwarth H. und Soffel K., Lebensbilder aus der Tierwelt, III, Leipzig, 1912, S. 64-65, 69, 71 (photograph of animals): 23) Miller G. S., Catalogue of the Mammals of Western Europe, London 1912, p. 525, fig. 103 L. t. scoticus (skull lateral, ventral and dorsal); p. 526, fig. 104 (teeth); 24) Barrett-Hamilton G., A History of British Mammals, 1912, part. XI, pl. XV (entire animal); p. 230, fig. 2 (skull lateral); p. 232, fig. 3 (palate); part XII, pl. XIX fig. 8 (hind leg); pl. XX, fig. 8 (hind leg); 25) Ognev S. I., Mlekopitayushchie Moskovskoi gubernii (Mammals of the Moscow Province), 1913, pp. 298-307, pl. III, pp. 45-50 (seasonal variations of fur); fig. 53 (skull of young blue hare); pl. IV, figs. 57, 60, 62 (photograph of skull); 26) Brehm's Tierleben, Säugetiere, II, 1914, S. 66 (half tone drawing of entire animal); 27) Filipchenko Yu. A., Izmenchivost' i nasledstvennost' cherepa u mlekopitayushchikh (Variability and Heredity of Mammalian Skull), Russkii arkhiv anatomii, gistologii i embriologii, I (2), 1916, pl. XVI, fig. 13 (skull dorsal, ventral); 28) Thorburn

A., British Mammals, Vol. II, 1921, pl. 34 (in autumn fur); pl. 35 (in winter fur); 29) Kishida K., An Explanatory Illustration of Japanese Mammals, ed. II, 1926, pl. II (in Japanese); 30) Wollebaek A., Norges Pattedyr, Oslo 1927, p. 22, fig. 17 (skull lateral); p. 23, fig. 18 (entire animal); 31) Kaverznev B. N., O zaitse i ego dobyvanii (The Hare and its Capture), Moscow 1928, p. 6 (track of a blue hare); p. 7 (tail of blue hare, its color compared with that of the common hare, a litter of the blue hare), p. 27 (running blue hare); 32) Bobrinskii N. A., Opredelitel' okhotnich'ikh i promyslovykh zverei (A Key to Game and Commercial Animals), 1928, p. 41, fig. 25 (drawing of tail); 33) Abe J., A Synopsis of the Leporine Mammals of Japan, Journ. of Science of the Hiroshima University, ser. B, Div. I (Zoology), Vol. I, 1931, p. 48, fig. 1 (Lepus ainu); p. 50, fig. 2 (Lepus timidus saghaliensis), pl. I (Skulls of Lepus ainu); pl. II (skull of L. t. saghaliensis); 34) Stakhrovskii V. G., Zayats-belyak (The Blue Hare), in the book: Verkhnevychegodskaya ekspeditsiya pod nachal'stvom S. V. Lobacheva (The Upper Vychegda Expedition under the Direction of S. V. Lobachev), Issue I, Moscow 1932, pp. 176-195, fig. 34 (an ensnared hare); 35) Heptner W. G., Zaitsy (Hares), Izdatel'stvo Soyuzpushniny, Moscow 1933, p. 4, fig. 1 (blue hare in winter fur - an excellent drawing); 36) Vinogradov B. S., Mlekopitayushchie SSSR (Mammals of the U. S. S. R.), Leningrad, 1933, p. 85, fig. 76 (A), fig. 77 (A) (bony palate and skull dorsal); 37) Manteifel' P. A., Zaitsy SSSR (Hares 203
of the U. S. S. R.), in the book: "Biologiya zaitsev i belok" (Biology of Hares and Squirrels), Moscow 1935, p. 18, fig. 2 (posture of female during copulation); p. 27, fig. 4 (one-colored blue hare); 38) Bobrinskii N. A., Opredelitel' zverei SSSR (Key to Animals of the U. S. S. R.), Moscow 1935, p. 50, fig. 40 (blue hare in winter fur); 39) Aspisov D. I., Zayatsbelyak (The Blue Hare), Volzhsko-Kamskaya zonal'naya stantsiya, Issue IV, 1936, p. 45, fig. 2 (embryos); p. 118, fig. 15 (diagrams of molt); p. 122, fig. 16 (photograph of molting specimens in spring); p. 125, fig. 17 (diagrams of molt); 40) Kolyushev I. I., Mlekopitayushchie krainego severa zapadnoi i srednei Sibiri (Mammals of the Extreme North of Western and Central Siberia), Trudy Biologicheskogo nauchno-issledovatel'skogo instituta, Tomsk, 1936, pl. I-II (photograph of skulls of L. t. begitschevi and L. t. sibiricorum); 41) Gureev A. A., Kraniologicheskie priznaki zaitsa belyaka i rusaka (Cranial Characteristics of the Blue and Common Hare), Trudy Zoologicheskogo instituta Akademii Nauk, III, 1936, pp. 356, 357, 362, figs. 1, 3, 5, 7 (skulls and details of their structure).

MATERIAL EXAMINED: 205 pelts and 246 skulls.

DIAGNOSIS. Head relatively large. Ears short, 1 1/10 to 1 1/8 as long as head (measured from occiput). Tail with terminal hair much shorter than hind foot (without claws).

Tail whitish gray in summer fur, markedly gray on dorsal side. Tail completely white in winter.

Winter fur of most forms sharply different from summer fur (except for Lepus hibernicus Pall.). Hares of the subgenus Lepus completely white in winter, only the tips of the ears remain black.

Summer fur coarse, guard hair dense, straight, not curling on back. Underfur curling. Hair of winter fur softer, longer and more delicate than that of summer fur. Underfur in winter much more luxuriant.

Teats: p. 1-1; a. 3-3, total 8.

Nasals measured along oblique line connecting anterior inner corner to outer posterior corner as long as, shorter than, or rarely longer than frontal suture.

Incisive foramina in their posterior third with rounded protuberances which are sometimes little marked.

Ratio of length of bony palate (measured lateral to the anterior process) to width of incisive foramina in their posterior third 70.24%.

Ratio of length of bony palate to maximal width of mesopterygoid fossa 72.7%.

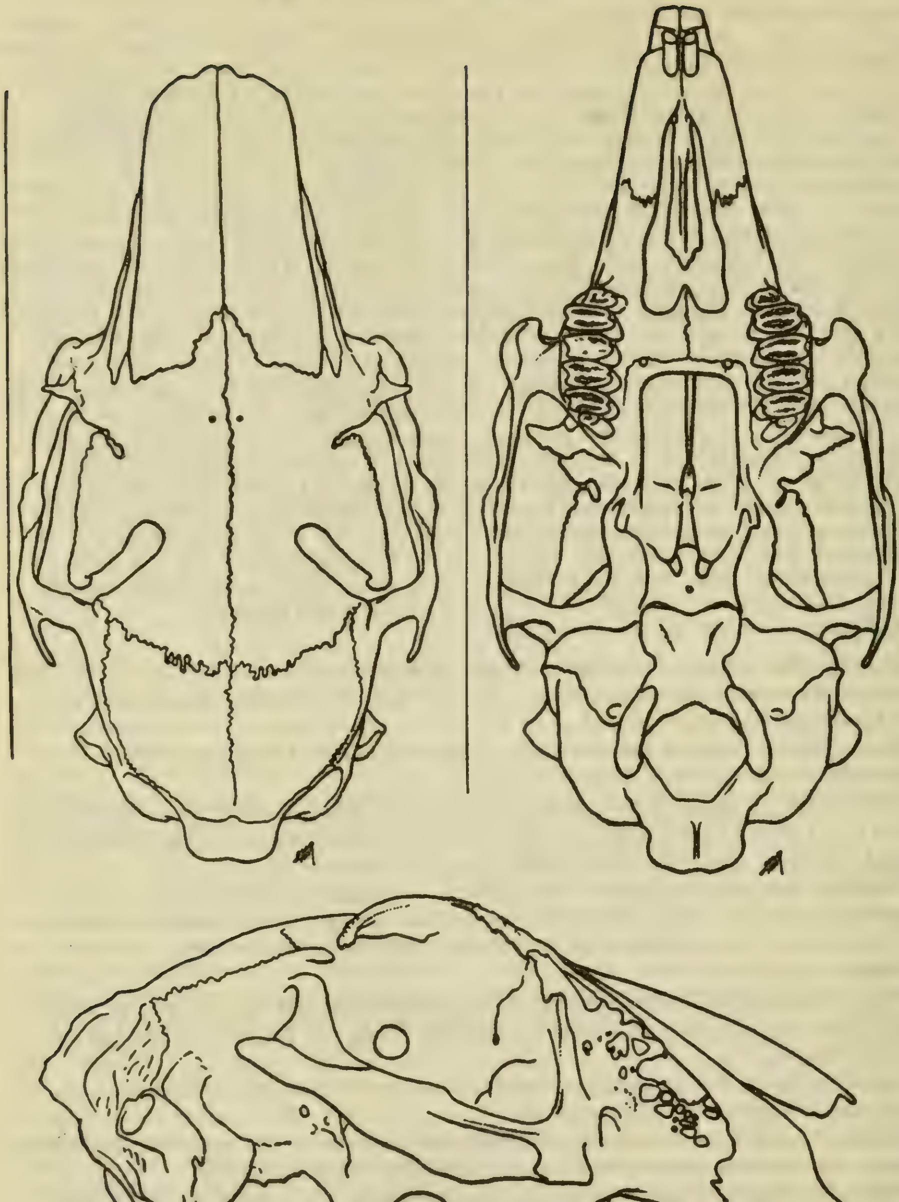
Ratio of length of row of lower molars to lower diastema 86.9%.

Lower anterior premolar slightly inclined backwards.

Mandibular condyle large, slightly inclined backwards.

Posterior-ventral plate of mandible (from angular process to notch at the beginning of the horizontal process) broad, longer than the distance between anterior alveolus of first premolar to tip of lower incisor.

204 Bullae osseae small and moderately inflated, slightly protruding anteriorly in profile.



FIGURES 107-109. Skull of blue hare, Lepus timidus kozhevnikovi Ognev. M. 3167, 17 November 1922. Shipov Experimental Forestry near Pavlovsk, S.I. Ognev's collection

Drawing by Yu. A Kostylev

204 Length of ear (measured from occiput) 110-118 mm; length of ear (along concavity 77-115 mm; hind feet 132-190 mm.

ADDITIONAL DESCRIPTION. Skull not as elongate and slender as in the common hare. It appears shorter because of the massive and wide zygomatic arches.

The characteristic differences between the skulls of the blue and common hare have been given above. The orbit is delimited by massive, zygomatic arches which rise steeply backwards. The zygomatic arch therefore forms a sharper angle at the anterior edge of the orbit than does that of the common hare. In series, or even in individuals, the species of a hare may be determined from the form of the orbit.

Nasals generally shorter than in the common hare. The ratio of length of the bony palate to the width of the incisive foramina and the mesopterygoid fossa gives reliable characters for identification.

The mandible is very massive.

Another reliable difference in the skull of the blue hare is the more vertical position of the lower premolar which is markedly inclined backwards in the common hare.

For biometrical differences between the skulls of common and blue hares, see description of the common hare.

COLOR. The color of summer fur of blue hares varies greatly in different localities. The color of most northern blue hares is darker and grayer than that of specimens from southern localities. Northern specimens also show marked blackish tones on the ears. We shall describe the color of the typical Moscow blue hare (L. timidus kozhevnikovi) as an example. We shall then describe the differences between this and a specimen of the nominate race (L. timidus) from northeastern Europe.

The color of an old Central Russian blue hare in summer fur is as follows. Chin and lips white. Anterior part of muzzle, cheeks and region around the eyes rich rust-brown (usually between cinnamon and sayal-brown, Ridgway, 1912, pl. XXIX). An admixture of black hair gives a duller tinge to the general tone in these parts. Black hairs become very numerous on the forehead, vertex and between the ears. Hair on forehead and vertex of several colors. In this region are guard hairs with gray-black roots, rust-colored bands in the middle and blackish tips. There are also completely black guard hairs in this region. Hair of underfur with gray roots and dull rust-colored tips. General tone of back rust-brown with
206 inconspicuous grayish black mottling. Fur of back much longer than that of head but of the same color. There are three types of guard hairs: 1) most numerous and typical are guard hairs with blackish gray roots, broad cinnamon-buff middle bands and blackish tips; 2) thinner guard hairs with paler and not so well developed middle bands; 3) the longest and coarsest guard hairs are completely black. Underfur on back curling, with grayish roots and very pale rust-colored tips.

Color of lower part of back near tail, flanks and a broad belt across the neck and upper part of the chest more gray than the parts mentioned above. The fur of these parts consists of guard hairs with gray roots, pale straw-gray middle bands and blackish tips. Longer guard hairs are also present here which are either completely black, or have narrow pale straw-gray subapical bands. Underfur dense, very curly, straw-smoke-gray.

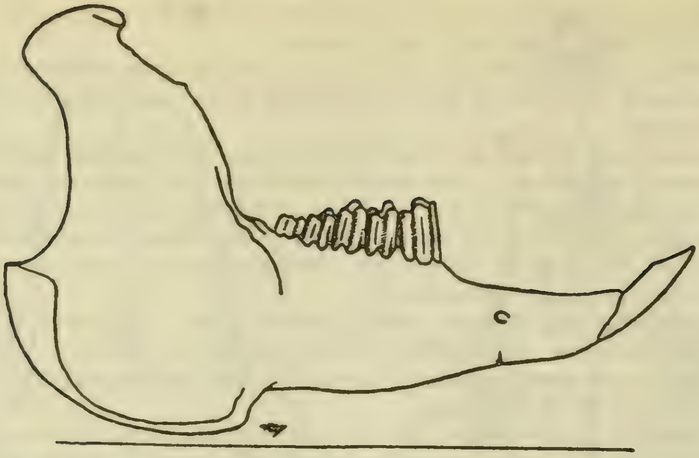


FIGURE 110. Mandible of Lepus timidus kozhevnikovi Ognev. M. 3167, 17 November 1932. Shipov Experimental Forestry near Pavlovsk, S. I. Ognev's collection

Drawing by Yu. A. Kostylev

Anterior side of fore- and hind legs with rust-brown hair with a strong admixture of black hair. Soles of hind feet with long fluffy dirty-gray fur. Tail uniformly gray.

Color of the anterior inner margin of the ears generally rust-brown. Inner sides of ears whitish gray. Outer margin with a dull rust-gray oblong patch. External margin of the ears with a white fringe. Posterior side of ears dirty brownish gray. Tips of ears blackish.

Vibrissae on cheeks and muzzle black and white. Color of longest vibrissae either black or white. There are occasionally long black vibrissae with white tips.

207 In the northern blue hare, the color of cheeks and anterior part of muzzle is dull straw-rust-gray. Color around the eyes the same. Forehead and occiput with a strong admixture of brownish gray hair. Hairs on these parts have broad blackish brown roots, narrow, pale rust-gray subapical bands and black-brown tips. There also are completely black guard hairs. General color of back dark, grayish brown with blackish gray mottling. Color of flanks and transverse stripe on chest grayer and duller than back, dull gray-brown (hair-brown, pl. XLVI, Ridgway, 1912).

Anterior side of legs dull gray-brown-rust colored. Ears with well developed black tone, especially on the inner side along the margin.

In contrast to the variable summer color, the winter color is constant, pure white. The following variations occur, however: 1) the color of the underfur may range between snow-white (e.g., in most Siberian blue hares, and in those from northeastern Europe), and delicate straw-white (e.g., in the center of the European part of the U.S.S.R.); 2) variation in length silkiness and luxuriance of hair. Blue hares from the northern and northeastern areas have longer, more luxuriant and silky fur. Specimens rarely occur in which the winter fur is not completely white, e.g., in the southwestern part of the range of the blue hare. Some gray hair tips persist in such specimens, giving the animals a peculiar smoky, grayish color*.

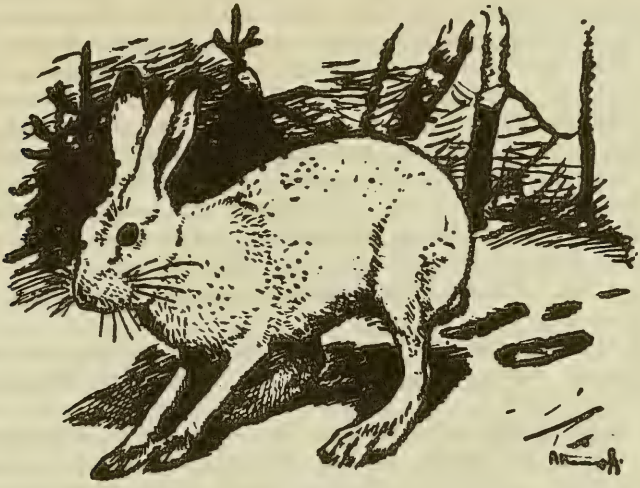


FIGURE 111. Blue hare in winter fur.
Drawing by A. N. Komarov

208 The weight of the blue hare varies with the locality: in the Verkhoyansk District, it reaches 1.600 kg [sic]; the heaviest blue hares from the Moscow Region weighed 4.400 kg; hares from the central Volga Region weighed up to 4.800 kg; large Chukchi blue hares weighed up to 5.800 kg. D.I. Aspisov (1936) gives the following weights for hares of the Tatar Republic. Females: average weight of 158 specimens 3.758 kg (minimum 2.600, maximum 5.100 kg); males: average weight of 217 specimens 3.336 kg (minimum 2.200, maximum 4.400 kg). There are some doubtful records of specimens weighing more than 5.800 kg.

SYSTEMATIC NOTES. Not enough attention has been given to the subspecific classification of the blue hare. The following subspecies are known in western Europe: 1) Lepus timidus timidus L. (Scandinavian Peninsula); 2) L. t. varronis Miller (European Alps, to an altitude of 1300 m and more); 3) L. t. scoticus Hilzheimer (high mountains of Scotland, northern England and Ireland); 4) L. t. hibernicus Bell. (Ireland). This is considered by many authors (e.g., G.S. Miller, 1912; G. Barrett-Hamilton, 1912) as a separate species. There are no important cranial differences between the Irish hare and the blue hare. The general appearance of L. hibernicus resembles that of the blue hare. The only differences are as follows: 1) fur does not become white in winter; 2) measurements larger; 3) ears longer; 4) interorbital space flatter; 5) postorbital process less elevated; 6) incisors larger and thicker. The Irish hare is possibly a well differentiated insular form of the blue hare.

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* A blue hare shot in the Spassk County, Ryazan Province (according to V. N. Shchepot'ev "Nature and Hunting" (Priroda i okhota), 1886, p. 83) apparently has such a winter color. The fur of this specimen is light ash-blue like that of the blue polar fox (Alopex lagopus beringensis).

Nine forms of Lepus timidus are known in the U.S.S.R. at present. This number may still be increased.

The taxonomic relationship between the blue hare and the North American hares in Alaska, Canada and Greenland can be determined only after examination of large series of American and European hares. American zoologists distinguish the following species and subspecies, which become white in winter or retain their white color in summer, from northwestern Alaska to Newfoundland: 1) Lepus arcticus (with subspecies) from Baffin Island to Newfoundland, Labrador, Banks Island, Prince Albert Peninsula to the tundra zone of Canada, from the Bear Lake, the northern coasts of the Great Slave Lake to Keewatin; 2) Lepus othus Merriam (tundra in north and northwest Alaska); 3) Lepus poadromus Merriam (Alaska, near Bristol Bay; 4) Lepus (Boreolepus) groenlandicus Rhoads (northwestern coast of Greenland, to the southern coast of Disko Bay).

Some of these species do not exist in fact; they form part of larger specific groups. For example, L. groenlandicus Rhoads belongs to L. arcticus Ross.

As was recently shown by Magnus Degerbøl and F. Wimpffen Braestrup
209 ("Vidensk. Medd. fra Dansk. naturh. Foren", Bd. 98, 1934, pp. 197-205), the incisors of L. groenlandicus which protrude much anteriorly are not a constant character; they are found only in the northernmost specimens of this race.

The arrangement of teeth is normal in hares in southern Greenland (L. a. porsildi Nelson). These authors came to the conclusion that the Greenland hare should be considered as a subspecies of arcticus, and that the creation of a separate subgenus Boreolepus Barrett-Hamilt. was not justified.

After comparison of the skull of Lepus arcticus with that of our blue hares, I came to the conclusion that they are very closely related.* These hares resemble each other in general and in morphological characters. It is highly probable that L. arcticus is only a subspecies of L. timidus.

According to A. Howell (1936), there are seven subspecies of Lepus arcticus: 1) L. a. monstrabilis Nelson (King Oscar Land); 2) L. a. arcticus Ross. (northern part of Baffin Island, Cockburn Land, Melville Peninsula); 3) L. a. andersoni Nelson (Prince Albert Peninsula, northern Mackenzie); 4) L. a. labradorius Miller (southern part of Baffin Island, northern part of Labrador); 5) L. a. bangsi Rhoads (Newfoundland, northeastern coast of Labrador to Cape Harrison); 6) L. a. groenlandicus Rhoads (northern part of Greenland); 7) L. a. porsildi Nelson (southern Greenland). If L. arcticus is considered as a subspecies of timidus, all the above forms should be considered as subspecies of the blue hare.

The position of Lepus othus Merriam can be determined only after examination of good material. In D. G. Elliot's opinion (1901), Lepus tschuktschorum Nordquist occurs in northern Alaska.

According to A. Howell (1936), Lepus othus Merriam is closely related to tschuktschorum. Their skulls are very similar both in general and in measurements. The only difference between them is the color of the summer fur. Lepus paodromus Merriam is smaller, and its summer fur has some specific characters.

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* Skulls of Greenland hares also belong to the "blue hare type".

If this view is accepted, North America from Alaska to Greenland is inhabited by various subspecies of the blue hare (Lepus timidus). This can be decided only after examination of series of American and European blue hares.

GEOGRAPHICAL DISTRIBUTION. The northern boundary of the range of the blue hare begins in eastern Europe, in Lapland and the Kola Peninsula. According to F. D. Pleske (1884) Lepus timidus occurs throughout the Kola Peninsula wherever it finds birch forests and willows. According to A. N. Formozov (1929) it is not found on Kil'din Island, but is common on the adjacent parts of the Murmansk Coast. In K. F. Kessler's opinion (1868) the blue hare was very common in the former Olonets Province. At present, it is widely distributed and occasionally very common in the Olonets Territory, where it reaches the coast of the White Sea and Onega Bay. Farther east, the boundary of the range of the
210 blue hare includes the greater part of the Kanin tundra, excluding its extreme north and the Timan and Bol'shezemel'skaya tundras. In these regions, the blue hare is distributed as far as the Arctic Sea. It does not include the Kolguev and Vaigach islands, and passes to the tundra north of the Urals. It is not exactly known where the northern boundary passes in this region, and especially where it crosses the Pai-Khoi Range to reach the Baydaratskaya Gulf.

The northern boundary of the range of the blue hare passes the Yamal Peninsula north of 70°N (near Lake Neite). B. M. Zhitkov (1913) observed the blue hare even farther south, along the river Khadyta. The boundary then follows the coasts of the Ob and Taz bays. The boundary of the range of the blue hare on the Gyda Peninsula coincides with the northern boundary of the tundra, i.e., 71°N. The species is very rare north of this line. According to W. G. Heptner (in litt., 1928), it occurs on the western Taimyr Peninsula, and even on Dikson Island. In summer it is common near the Pavlovskii Base (30 miles from Dikson). It is rare between Dikson Island and Cape Polyn'ya. It occurs in large numbers near Lake Pyasino. Near Dudinka on the Yenisei, where there is shrubbery, it is numerous and resident. Farther east, it occurs on the Taimyr Peninsula. In A. Middendorf's opinion (1867), the northern boundary of its distribution on the Taimyr is 75°N, where a litter was found. It occurs along the lower reaches of the rivers Khatanga (according to A. F. Chirkova), Anabara, Olenek and Lena, reaching their estuaries.

I received detailed observations on the distribution of the blue hare on the western Taimyr from A. A. Kirpichnikov (in litt., 1936): "The blue hare occurs in small numbers throughout the year along the southwestern Taimyr Coast to the Pyasina river. It was also found sometimes in winter on Dikson Island. In the second half of November 1933, a blue hare was caught on Rastorguev Island south of 74°N. The blue hare becomes very rare near the Pyasina Bay. It is not found on the Minin Cliffs nor on the coast of Khariton Laptev. Latitude 74°, which passes along the right coast of the Pyasina Bay, is possibly the northern boundary of the range of the blue hare on the western side of the Taimyr."

E. O. Shereshevskii contributed important observations (in litt., 1936) on the distribution of the blue hare in the northern parts of East Siberia. Tracks and fecal pellets were found frequently during Shereshevskii's

1935 expedition along the coast from Cape Chelyuskin to Andrey Island, and also on the Samuel, Fram, and Faddey islands. In Pronchishchev Bay, a blue hare was caught in a trap (April 1935). Shereshevskii has no doubts that the blue hare reaches the sea in the Taimyr in years of intensive multiplication and migration, and passes to the littoral islands across the ice. The islands mentioned above are 2-12 km from the coast.

According to Shereshevskii, the blue hare occurs in the valley of the Yana (below Ust'-Yansk), in the Khroma Basin, and reaches the sea. It also occurs in the estuary of the Kolyma (according to S.A. Buturlin).

The blue hare does not occur on the New Siberian Islands. According to fur traders, it was caught once or twice on the Bol'shoi Lyakhovskii Island.

212 The boundary thus passes along the eastern tundra of Siberia as far as the northern coast of the Chukchi Peninsula.

We shall now examine the eastern and southern boundaries of the range, from eastern Siberia to the west of the European part of the U.S.S.R. The blue hare occurs in the Chukchi and Koryak territories as far as the Olyutorski Gulf, the Penzhina and Gizhiga bays. It is also found in Kamchatka. According to S. Barmantov (1933), it is not numerous in the Kronotski Reserve. The occurrence of the blue hare in Kamchatka is also mentioned by S. Krasheninnikov in the chapter "Terrestrial Animals" (O. Zveryakh zemnykh) of his book "A Description of Kamchatka" (Opisanie zemli Kamchatki, second edition, Vol. I, 1786, p. 210).

The eastern boundary includes the whole Maritime Territory, the entire coast of the Sea of Okhotsk, and the Tatar Gulf (to about 45°N). The blue hare also inhabits Sakhalin and Hokkaido.

In the Far East, the southern boundary crosses the region of Lake Khanka (but does not reach Vladivostok), and continues westward, excluding Manchuria. In A. de Sowerby's monograph (1923) this species is reported neither for Manchuria nor for Barga [Hulunbuir District] of the Heilungkiang Province* (A.S. Lukashkin, 1933). The southern boundary probably runs northwest from Khanka crosses the river Sungari, and possibly continues as far as the Amur. From Aigun, the southern boundary turns south and the species occurs in the northern and central parts of the Great Khingan (G. Radde, 1862; A.S. Lukashkin, in litt., 1936). Farther west it is encountered in the valley of the Onon river together with the Tolai hare (Raddle, 1862).

The blue hare apparently occurs in the Hentey, although it has not been recorded from there. Farther west it is found in Urianghai [Tuva Autonomous Region] and near Lake Höbsögöl in northwestern Mongolia (Radde, 1862). The exact course of the southern boundary west of this point is not known. The blue hare certainly occurs in the Sayan Mountains and on the Altai. It is absent in the Tarbagatai, as the environment is not suitable. A.M. Nikol'skii (1887) recorded it from Sergiopol [Ayaguz]. According to V.N. Shnitnikov (1925), it occurs in northern Semirech'e (Dzhety-Su), where it is sometimes numerous in the Lepsinsk District and in the former Kopal County. However, I doubt whether it occurs farther west than Abakumovskoe. It occurs in the Ala-Kul and Sasyk-Kul districts. West of Sergiopol, the southern boundary turns north towards Karkaralinsk and Akmolinsk [Tselinograd]. The exact boundaries in this region are not known.

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* [Now Inner Mongolian Autonomous Region.]

From Akmolinsk, the boundary probably continues to Atbasar, passing between Kustanai and Turgai. It then turns southwest passing south of Aktyubinsk along the northern foothills of the Mugodzhar Mountains, and touches the middle reaches of the Ilek river (N.A. Zarudnyi, 1897). It then reaches the Ural river, and includes Obshchii Syrt south of Uralsk (approximately 51°N). The exact course of the boundary from Obshchii Syrt to the Volga is not known. It turns sharply north to the Samara Bend, excluding the Trans-Volga Steppe. In the lower Trans-Volga, M.N. Bogdanov (1871) observed this hare in the northern part of the former Kamyshin County, where it was very rare. It was not recorded from this
213 district by V.E. Martino (1913). We assume that the southern boundary of the range of the blue hare in the Volga Region passes between Volsk and Saratov. It then turns north to Atkarsk and Serdobsk, continues to the former Penza Province and passes between Morshansk and Tambov. The blue hare is sporadically distributed in the Tellerman Wood on the Khoper, near the town Borisoglebsk (A. Silant'ev 1894), farther south in the Grafskoe Forestry, north of Voronezh and in the Shipov Forest in the Pavlovsk District.

From the Morshansk and Tambov region, the southern boundary runs towards Ranenburg [Chaplygin], where the blue hare is very rare. The boundary then passes north of Tula, turns sharply south to Odoevo, Bolkhov and passes near Khotynets (Riga-Orel Railroad). Farther south, the boundary includes the basin of the Desna with its tributaries Navlya and Nerusa (former Trubchevsk County, Orel Province). The main southern boundary then turns west towards Novgorod-Severskii (52°N) and continues to south of Novozybkov (Dm. Vilinskii, 1885). Farther west, the blue hare occurs in the forests of the Mozyr Polesye (A.G. Fedyushin, 1927) and farther south, in the forests of the Ovruch District (M. Baklashov, 1877). The boundary then turns sharply north, includes the area of the Pinsk Polesye and continues in Poland towards the area north of Bialystok and Novogrudok (E.R. Lubicz-Niezabetowski, 1934).

In addition to this "main" southern boundary in the southern Ukraine, there are scattered, small, isolated areas where the species has perhaps survived until the present. For instance, a blue hare was found near Sumami. In the collection of the Moscow Zoological Museum is a pelt and skull obtained by A.V. Apollonov (1913) from the northern part of the former Sumy County of the Khar'kov Province. According to N.I. Gavrilenko (1928), blue hares rarely occur in the former Zenkov, Poltava and Konstantinograd [Krasnograd] counties of the Poltava Province. In his opinion, they are the offspring of specimens introduced by the former landowner Kharitonenko in the former Bogodukhov County of the Khar'kov Province.

Professor K. F. Kessler (1850) recorded blue hares from the Volhynian and Kiev Provinces. In 1844 a blue hare was obtained in the Radomysl County. In 1848 such a hare was observed in the vicinity of Kiev, where it was still very rare. According to E.V. Sharleman (1915), it occurs very rarely in the former Kiev Province. It was observed in a drive near Korsun', former Kanev County of the Kiev Province.

M. Shcherbina (1924) reported that he observed a blue hare on 4 February 1917, near Ivintsy, former Zhitomir District. V. Khranevich (1925) states that it is very rare in Podolia. One was killed near the village Cherepovaya of the Proskurov County. Another was killed near Zin'kovtsy of the former Kamenets Podolski County.

Except for these fragmentary records, we have no data on rare and accidental captures in the southern and central Ukraine. We repeat that 214 these isolated records lie outside the constant range.

The population of the blue hare is subject to great fluctuations due to ecological conditions which vary from year to year.

In conclusion, the discovery of fossil remains of the blue hare in the Crimea may be mentioned (S.K. Dal', 1928). During the construction of the Ayanskii Basin on the Petrovskie Rocks near Simferopol, numerous remains (mainly mandibles) of blue hares were found in Karst caverns which were partly filled with sand. In S.K. Dal's opinion, the presence of the blue hare in the Crimea was short lived. It apparently entered the Crimea during the Würm glacial, when the ice reached 48-50° N, and the land bridge connecting the Crimea with the Continent was 200 km wide. At the end of this epoch, the blue hare disappeared and the common hare settled in the Crimea.

Although some details of S.K. Dal's theories are questionable, there is no doubt that the blue hare was formerly distributed farther south, and that it was driven back north as a result of cultivation.* This results in restriction of the range of the blue hare, contrary to the phenomenon observed in the common hare. As shown above, the range of the common hare gradually expands, especially in northern, eastern and southeastern directions.

MODE OF LIFE. Habitats. In the central belt of the European part of the U.S.S.R., the blue hare is very frequently found in dense undergrowth with willow and alder shrubs, and in undergrowth consisting of birch and spruce. It occurs among fallen trees in clearings covered with branches and logs, or in broken terrain in which forest alternates with ditches and forested gullies. It is also attracted to spruce forests mixed with birch and aspen (opened by felling), where the ground is mossy, especially where fallen trees are numerous.

The blue hare occurs in definite habitats in southern European forests, on the southern border of its range. For example, in the Shipov Forest, former Pavlovsk County of the Voronezh Province, and in the Tellerman Forest on the Khoper, the blue hare prefers aspen groves. According to P.A. Polozhentsev (1935), it occurs in all types of plantations in the Buzuluk Forest. However, it prefers shrub thickets and pine nurseries. It occasionally causes them great damage by gnawing the bark and eating buds. 215

In the north of the European U.S.S.R., e.g., the Kola Peninsula, the range of the blue hare is connected with birch forests and osiers. It also enters the tundra.

In western Siberia, the blue hare is widely distributed in the forests, mainly in floodlands with willows. For instance, L.P. Naumov observed it in such habitats in the Surgut District. It occurs in the same habitats in the Yenisei forests, e.g., along the Tunguska.

"The blue hares are most numerous in valleys of large rivers with dense willow thickets, or on the shores of lakes and at the edge of small forests in the tundra. It is often found on the banks of small streams overgrown with forests of larch, spruce and cedars with dense alder and willow underbrush. It is rare on mountains tops and in the bare Taiga almost devoid of underbrush. It is very fond of dense undergrowth on mountains, where it makes many tracks. It was not seen on bare, stone-covered high mesas."

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* See M.N. Bogdanov's map of distribution in the article "Game and Trade Birds and Animals of the European Part of Russia" (Okhotnich'i i promyslovye zveri i ptitsy Evropeiskoi Rossii, "Okhota i konnozavodstvo", No. 3, 1873, p. 63 (Map 3)).

According to G. G. Doppelmeyer (1926), the blue hare is common during the summer near Lake Baikal, in willow thickets of estuaries of rivers, in birch groves, and in pine forests. According to D. K. Solov'ev (1920), it is found on the Sayan Mountains up to the "belogor'ye"*. According to A. M. Kolosov (1933) it is found on the Altai in the high-mountain tundra (e. g., in the Teletskoe Lake Region) in dense thickets of polar birch (Betula rotundifolia) and willows (Salix herbacea, S. reticulata). According to G. N. Gassovskii (1927), in eastern Siberia (in the Gilyui-Ol'doi Upland) blue hares occur in large numbers in regions overgrown with Pinus pumila, on the crests of ranges between the Great and Lesser Yurmakit Mountains, along the Gilyui and Getkan, and especially among willow and black-crowberry shrubs. In Transbaikalia, blue hares occur not only in the forest zone, but also in the Daurian Steppe, e. g., along the Onon river.

In the West Siberian forest-steppe, at the southern limit of their range, blue hares often occur in reed thickets along the shores of lakes, and in willow thickets. They are also found in birch and oak groves and in vegetation along rivers. I found numerous blue hares in these habitats in the valley of the Belaya river in Bashkiria.

In the forest steppe and steppe, the blue hare typically lives among so-called "black alder pollards" overgrown with nettles, Umbelliferae, shrubs of dewberry, wild rose and raspberry. Such habitats are also typical of the Bashkirian blue hare. In north Siberia it lives in the stunted forest tundra. It is also widely distributed in the open tundra.

S. P. Naumov writes: "The blue hare concentrates in river valleys overgrown with trees and shrubs, in the forest tundra, but its tracks are often seen on watersheds... this changes completely when we enter the tundra, especially the part in which the last high shrubs (Alnus fruticosa) disappear. The absence of large trees and shrubs compels
216 the hare to seek other shelters. It finds them in the high, precipitous, eroded cliffs common in some parts of the tundra. Here the sporadic distribution of the blue hare is even more striking. One may pass tens of versts without finding a single animal or its tracks. However, in the habitats mentioned above the blue hare is very numerous; one may see sometimes ten or more without leaving a place. Only frightened hares run far into the tundra. However, they do not go beyond the limits of the broken, hilly area."

GENERAL DESCRIPTION AND HABITS. The movements of the blue hare are rapid. It is an agile animal. According to a popular concept the hare is very timid. The blue hare was considered especially so, and was therefore named "timidus" by Karl Linné. After observing its behavior in nature it is hardly justifiable to consider timidity as one of its main characteristics.

V. N. Kaverznev (1928) writes: "It is not justifiable to consider timidity peculiar to the hare. The fact that it takes flight when it senses peril does
217 not prove that it is timid. Had it failed to do so, it would have been

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* [Flat alpine massifs.]

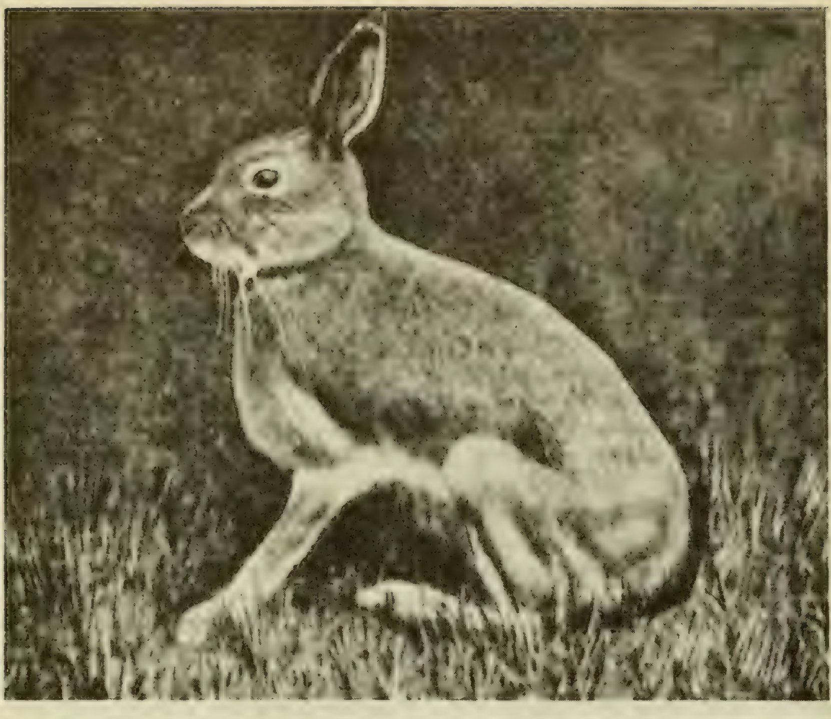

FIGURE 112. Blue hare in summer fur

Photograph by S. I. Ognev

exterminated. It is badly equipped for resistance, but has enemies at every turn. All animals try to escape danger. Even the most redoubtable predators usually avoid meeting man. They fight only exceptionally, prompted by hunger or despair.

"It has been stated that a hare trembles when it is caught, which is true especially of the nose, lips and whiskers. If this nervous phenomenon really exists, it is not peculiar to the hare, and should not be ascribed to fear alone.

"Confusion is one of the main symptoms of fear. The hare does not show panic when hunted by greyhounds, and in a hopeless situation. Its dodges, hooks, and jumps in face of the dogs are proof of purpose which would not be present in a state of panic."

Its sense of hearing is best developed. Its sight is poor, but its sense of smell is well developed. The blue hare is a taciturn animal. According to P.A. Manteifel' (1927) males and females make sounds resembling a moan during estrus.

A hunter of the Military Hunting Company, M. Potapov, informed me that the spring cry of the male resembles the tawny owl's cry "uik-uik", but is shriller. It is intermediate between the cry of the tawny owl and that of a blue hare when it is caught by hounds. The female makes a peculiar smacking sound produced by drawing air through pursed lips. According to Potapov, males are attracted by this sound. Hunters from Shar'ya told A.N. Formozov that the sound of the female described by Potapov is not the female's voice, but the voice of young hares. They claimed that male and female run to help the young in response to this sound. There is even a method of hunting using this sound to attract the hares.

Other hunters stated that the cry of the male blue hare sounds like that of the forest owl (Asio otus), like "o-kho-kho-kho". N.R. Obrecht maintains that he saw male blue hares raising themselves on their hind paws, emitting this cry and afterwards running with lowered head, sniffing the track of a female which had passed. Other hunters gave the same description of the spring cry of the hare.

Even on this simple question, opinion is divided and the problem should be further investigated.

A wounded hare captured by hounds or men usually emits a shrill squeal like that of screaming piglet or child.

Footprints of the hare in the snow clearly reflect its various gaits. When it is foraging, it moves slowly, leaving in the snow parallel elongate footprints of its hind feet followed by consecutive rounded footprints
218 of its forefeet. When it runs, the footprints are more elongate. The traces of the hind feet are parallel, but one of them slightly in front of the other. The traces of the forefeet are further behind those of the hind feet. Sets of traces are separated by a large space, the length of which depends on the speed of the hare. A hare in a great hurry leaves tracks with even wider intervals and greater spacing of the footprints.

Before going to sleep, the blue hare "covers" its track by jumping to the side, away from its main direction. It may also go along paths or ruts in the snow, where its track is usually not perceptible. Its sideways jumps are called "hooks". Many naturalists and hunters think that the hooks of the hare are proof of its cunning. The hare thus covers its tracks and leads its persecutors astray. The hare often passes from recent snow to paths or ruts and makes hooks for a considerable distance in order not to leave a plain track. This may be instinctive cunning . Hooks may be regarded as a behavior pattern acquired during evolution and are probably a reflex activity not involving any conscious cunning.

219 V.N. Kaverznev (1928) writes: "I would consider the inventiveness of the hare in covering its track to the lair as cunning, and not as inherited from preceding generations. The method follows principles, according to which the animal performs stereotypic double and triple hooks. I would also consider as cunning the rare cases in which the hare lies in a depression, in an empty fox burrow, or between boughs of a fallen tree, if it were possible to prove that these places had not been chosen accidentally. These activities reflect an instinct to conceal the lair, and not the track leading to it. In other words, they are manifestations of the animal's efforts to hide.

"For instance, I do not consider double and triple steps* a method of confusing the track. I consider the double step an everyday occurrence. After covering some distance in search of a lair or food, the hare returns to make sure it has not missed a place or an object, or in order to rest. In some cases, I observed a hare making a double step, nibbling a plant, and finally covering its track.

"After finding a suitable lair, the animal makes a hook towards it. If the lair is unsuitable, it continues its course. This is the reason for the absence of hooks from triple steps. The hare's habit of performing hooks before resting is probably the result of its old habit of jumping aside and lying down when chased. It probably generalized this habit to everyday cases of lying down to rest."

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* Double and triple steps mean a double or triple repetition of tracks by returning along the line of the track.

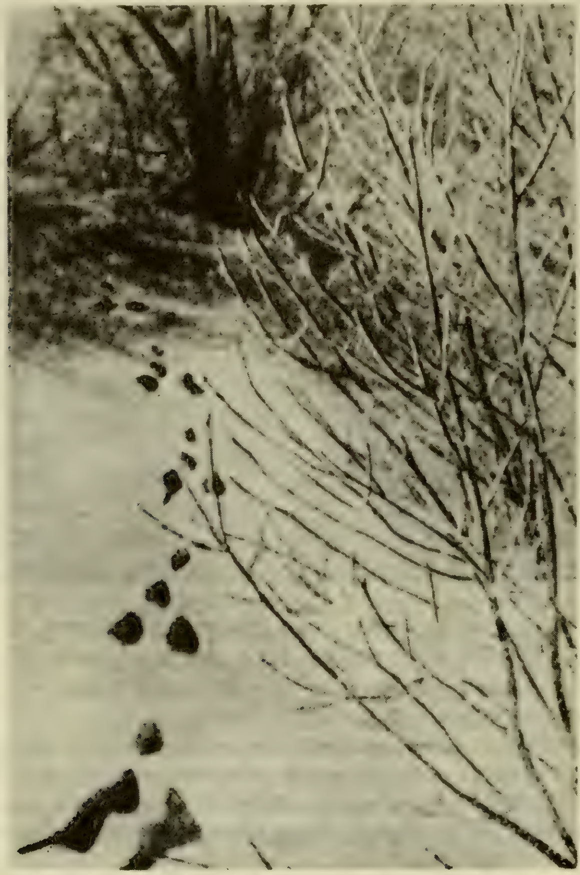

FIGURE 113. Tracks of slow walk of a foraging blue hare
Photograph by S. I. Ognev

220 It often stops by the way, and changes the direction of its course. All this confuses its track. Using an anthropomorphic argument, all these phenomena can be explained from the point of view of human logic, by ascribing cunning to the hare. However, such anthropomorphic interpretations are probably not valid.

The hare is a typical land animal and its rapid progression is therefore on the ground. It does not run rapidly only on even ground. It can move safely and quickly on mounds and steep slopes. Difficulties appear when the hare runs quickly down a steep mountain. As it has long hind legs, it sometimes turns end over end in a somersault, as if shot. The hare climbs precipitous mountains rapidly and safely owing to the build of its legs.

Even when the animal could escape by running over an even space, it may choose to climb a mountain, rapidly ascending the steep slope.

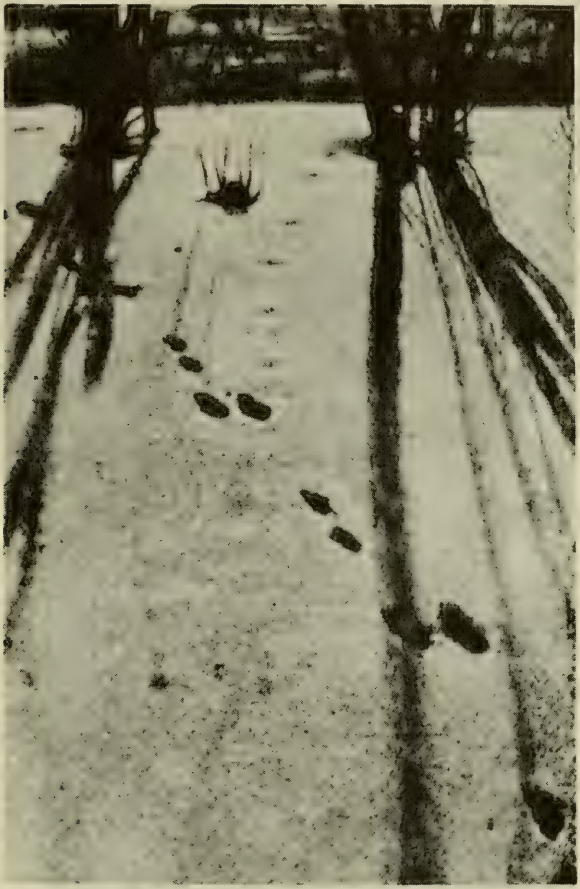

FIGURE 114. Track of a hurrying blue hare

Photograph by S. I. Ognev

The blue hare is a strong and good swimmer. During floods, herds of hares may collect on islands. If necessary, they swim across the water to escape floods. When chased by hounds, the hare often jumps into the water and easily crosses large rivers. It holds its ears backwards during swimming.

Floods in spring are often fatal for the hares. The tired, soaked animals have to escape from one island to another. Finally they die of exhaustion. During this difficult period, the hares are also hunted by
221 hawks and eagles and by poachers.

The hares may escape to ice floes, small spits and islands, and gather on stumps and heaps of brushwood. The hunters do not shoot them, but kill them with clubs. They may kill 20-30 specimens daily, including many gravid females.

DAILY LIFE. The blue hare is a crepuscular animal, its activity beginning in the evening, when it comes out to feed. During the day and in the late morning the hare usually lies in a shelter or moves slowly about a small area in sheltered, safe places. The activity of the blue hare ceases at night and begins again early in the morning.

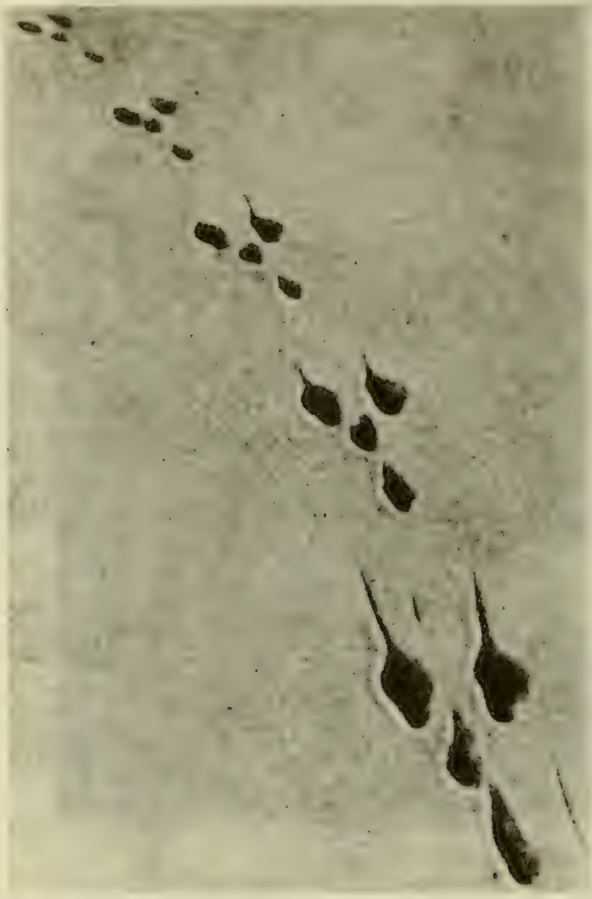

FIGURE 115. Track of slowly moving blue hare

Photograph by S. I. Ognev

V. G. Stakhrovskii (1932) observed blue hares in a large open-air cage. He describes their daily life as follows. The hares emerged from the lairs at sunset (which was very early in winter and much later in spring and summer). They rose one after another, and 15-20 minutes after the first hare rose, all were feeding. In the morning they fed and basked in the sun for a long time. In summer they were often seen walking at 6.00 a.m. On several occasions, Stakhrovskii saw hares in the early morning hours playing with each other, rolling in the dust of a sown oat field. The animals rolled on their backs and from side to side, their long hind legs dangling ridiculously in the air.

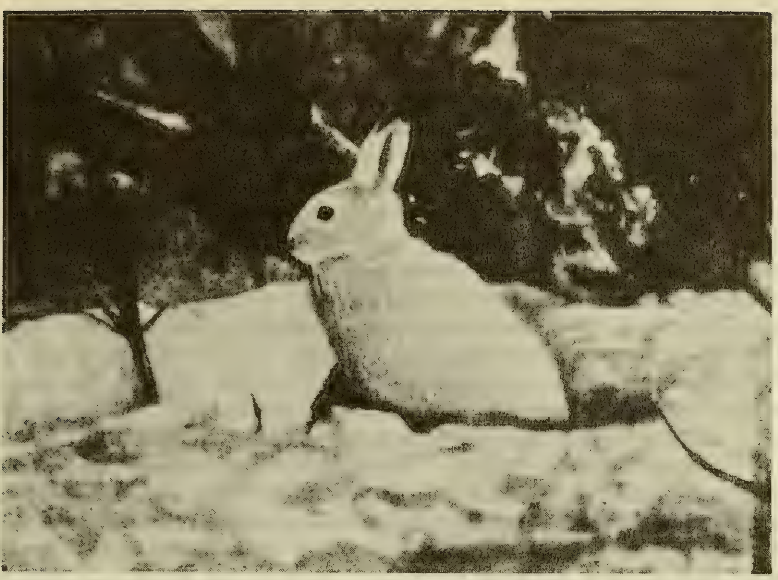

FIGURE 116. Blue hare in winter

Photograph by S.I. Ognev

V.G. Stakhrovskii could not find out whether the hares are active at 222 night. Some observations indicate that they are not. This view was confirmed by S.V. Lobachev, who watched at night in sheds on oat fields, and noticed hares only in the evening or in the morning (not between the hours 11.00 p.m. and 3.00 a.m.). During quiet, moonlit, winter nights, they feed and leave footprints even after midnight.

NESTS AND BURROWS. In the European part of the U.S.S.R. the blue hares do not build lairs or burrows to raise their young. The female gives birth in a concealed place under shrubs or fallen trees. According to P.A. Manteifel, the young are active on their first day. In autumn, especially when there is no snow, the hare, which has become white, conceals itself very carefully. It hides under overhanging roots, under a fallen tree, shrubs, etc. In winter, when there is deep snow, the hare lies down under a snow-covered bush after making a hook. It sometimes breaks the snow and builds a well-concealed shelter. When it is discovered it jumps energetically, spraying snow in all directions. After a moment, the hare becomes visible on the white background of the landscape.

In eastern Siberia, blue hares occasionally make large burrows in the snow. L.O. Belopol'skii (in litt., 1936) writes that in winter, along the Anadyr river, the hare usually remains in the region of shrubs and dwarf forest. It rarely enters the tundra or the mountains. Among shrubs, Belopol'skii occasionally found burrows in the snow 80-100 cm deep, for instance, near the estuary of the Anadyr river (23 November 1930).

Blue hares in northeastern Siberia occasionally build permanent communal burrows on hills and steep river banks. Such a colony was described by A.F. Girikova (in litt., 1935).

"I had the opportunity of observing hares during our journey to the lower reaches of the Khatanga (from village Khatanginskoe up to the Bol'shaya Korcha locality). We saw very few hares in the forest belt. They appeared

only in the tundra which begins south of the Krestovskii Peninsula. The first striking fact was the "symbiosis" between two predaceous birds, buzzards and merlins, and hares. We observed the same phenomenon in four places along the river. The presence of these birds proved to be a reliable indication of the presence of hare burrows. Small groups of hares, possibly including young, could always be found near nests of the birds, as if they were under their supervision. The nests of the birds were always on top of the escarpments. Below them were the colonies of hares. I carefully observed such a colony near the village Novoe Rybnoe. This group of hares lived near a merlin nest, and apparently consisted of one litter
223 (five hares killed proved to be young of the same year*). The hares occupied seven conical hills along the Khatanga river (for about 1/2 km). The cliffs here reached a height of 20-30 m. The surface of the escarpment was sandy with occasional clay outcrops from the underlying bedrock. Here and there it was covered with fine shingle. The sandy parts of the conical mounds were covered with dwarf tundra vegetation consisting of weeds, tundra birch and osier. When people appeared, the hares began running anxiously in circles about the conical hills, always returning to certain points. Near these points we found their burrows.

"These burrows were clearly inhabited. Around them we found numerous tracks, pellets and remains of food. I saw hares emerging from the burrows. At first we thought that these were abandoned burrows of polar foxes, which had been temporarily occupied by the hares. Closer examination showed that they had been dug by the hares themselves. They were usually located at half the height of the conical hill and had one or two exits. The burrow went first to a depth of 1-2 m into the ground. This section was followed by a turn. We could not excavate the burrows, because they led into the depth of the hills. One inhabited burrow was on a small hill in a ravine descending to the river. It had one exit with three small air vents located 2 m above the exit and on either side. We concluded that the burrow branched in the ground on a small platform above the exit, which was 16 cm high and 39 cm wide.

"The air vents of another burrow were located along a crack in the ground. The largest burrow (25 × 35 cm) was on the greatest conical hill. It had one exit on either side of the hill and apparently passed through it. The distance between the two exits was 7 m. There was a track on the surface of the hill connecting the two exits. Both the exits and the track were located on a shingle-covered slope, so that even a small animal could not approach the burrows without making a noise. Several burrows with one exit were empty. We also found some recent, unfinished burrows.

"On top of one mound we found a whole network of collapsed corridors and small round pits which had been inhabited by young hares. Their small pellets were still there. The burrows of the young hares were very close to the merlin nest (about 10 m)."

A. F. Chirkova's description of these colonial burrows of the Khatanga blue hares is interesting in many respects. No other subspecies is known to have such habits. The Khatanga hares are a well-differentiated subspecies.

NUTRITION. The blue hare lives on a diet of grain, grasses, berries (e.g., bilberry and raspberry) and twigs. The hare avidly feeds on aspen and willow twigs. V.G. Stakhrovskii (1932) reports that during the 224 Verkhnevychegod expedition he repeatedly saw blue hares in pine forests, bilberry and pine thickets with spruce, especially near marshes. It seems that the blue hares fed mainly on bilberry, especially its roots. V.G. Stakhrovskii (1932) studied the food of the blue hare in the open-air cages of the Losinoostrovskaya [Babushkin] Biological Station. The animals fed on the following plants which grew in the cages: Poa trivialis, P. amnia, Carex pilosa and raspberry. They also ate willow, birch and aspen shoots. In September the hares began to feed on the bark of willows, aspens, nut trees, young oaks, and even bark and branches of spruce. They visited especially sown fields of oats, sunflowers and clover mixed with millet. Their favorite food was unripe oats. They did not touch potatoes, parsley or carrots. Experiments showed that the blue hares accepted branches and bark of the following trees: aspen, poplar, willow, birch, nut-tree and also oak. They completely ignored honeysuckle, spindletree, elder, buckthorn, linden and European bird cherry.

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* It seems doubtful that one litter could occupy such a widely spread system of burrows.

Detailed observations on the food of the blue hare are given by D.I. Aspisov (1936). In summer, blue hares in the Tatar Republic are especially fond of Melica nutans, Calamagrostis, Greek valerian, cornflowers, and Picris hieracioides. They paid little attention to Aegopodium and ground ivy.

In dry mixed forests hares generally live on birch, aspen, nut trees and willow in winter. In floodlands they live on osier, willow, oak, and aspen. In oakwoods they live on maple, oak, nut trees and rarely on birch and aspen.

When there is little snow, they feed on the following plants: sprouts of winter rye, Brassica campestris L., Agropyrum, Calamagrostis, angelica, Chicory, Chenopodium, Artemisia, Arctium and nettle. The first two are especially favored by the hares, who often have to dig the plants out of the snow. They usually bite off the parts protruding from the snow.

REPRODUCTION. In the central part of the European U.S.S.R., the estrus usually begins in the middle of February and lasts until the end of July. The females have 2-4 litters during the summer. D.I. Aspisov (1936) thinks that blue hares normally have 3 litters each summer. In western Siberia, for instance in the Tara District, estrus begins in March (I. Shukhov). In northeastern Siberia it begins much later, in the Kolyma Territory only in late April (S.A. Buturlin). The genital organs of all hares caught in early May were clearly swollen. According to Aspisov, the first litter usually consists of 3 young, the second of 5 and the third of 3. Most females have two litters a year, producing 8 young. The natural death rate among the young reaches 35-40 per cent. The progeny of a female in late summer and early autumn is thus reduced to about 5 young. The young generation is about four times as numerous as the adult population.

225 In the north of the European U.S.S.R. the first litters sometimes appear as early as in March. The hunters call the young of these early litters "March hares" or "hares of the frozen-snow period". The last litters appear in September or later, and are called "autumn hares" by the hunters. In the hunting literature we find many cases of late pregnancy in blue hares. In the the "Hunter's Gazette" (Okhotnich'ya gazeta, No. 17, 1889) we read that a gravid female was caught in late December in the former Petersburg

Province. According to Aspisov (1936) litters normally appear in Tataria in early May, the last days of June and the first days of August. According to Aspisov, earlier or later litters should be considered as accidental, which do not give a true picture of the normal biology of the hare.

P.A. Manteifel' ("Hares of the U.S.S.R." (Zaitsy SSSR) in "Biology of Hares and Squirrels" (Biologiya zaitsev i belok), Moscow 1935) reported the following observations on the reproduction of the blue hare in the Moscow Zoological Garden.

He writes: "The males started chasing a female blue hare on 5 April 1927, and another on 7 April 1927. The estrus was rapid and violent. Four males chased one female, The female ran away from them and made sudden sideways jumps. The males drove each other away from the female. They collided while running, leaped and struck each other with their hind legs so that fur flew. When they halted, they bit each other and quarreled, scratching each other with their forelegs. They huddled behind the female which suddenly stopped. The most agile male leaped on the female. The female raised herself high on her feet and curved her back (Figure 76). The other males began scratching and biting the copulating animals, jumped over them and kicked the male with their hind legs.

"Only a very persistent male could have fertilized the female under these conditions. After copulation the female lay down in a depression, breathing heavily. The males did not touch her, but occasionally they attacked each other. The males sometimes mounted each other. When they had lost sight of the female, they tried to find her, running about and sniffing the ground. During this they often sniffed each other quickly and then continued the search. Their sense of smell is apparently not sharp enough, because they often passed a female lying on the ground, without noticing her.

"The estrus of the female, during which she copulates frequently, does not last more than 24 hours, generally only 10 hours. Copulation is brief as in rabbits. The penis looks like a long hook with a sharply curved end. This forces the male to push his hindquarters under the legs of the female while he holds her with his forelegs. It also compels the female to rise high on her legs and to curve her back.

"The estrus of the male is equally active during day and night. Observations in the Moscow Zoological Garden showed that the female had intercourse about every half hour. It was mounted most of the time by the
226 same male."

According to P.A. Manteifel' gestation lasts 48-51 days. The young are generally born on the 50th day. They are born with open eyes and are covered with curly wool. Their ears stand up as in adults, and the upper and lower incisors are visible outside the gums. The stomach of one-day-old hares contains curds. Their weight at this age is 84-140 grams. The young suck about 40 grams of milk on their first day. The milk of the female is very fat. Milk in the stomach of a newborn blue hare contained 23.6% fat. Immediately after birth the newborn young suck their fill, scatter and hide in the grass. Their development is influenced by the following peculiar maternal instinct. When the puerperal estrus (which lasts about 10 hours) is over, and she comes across the track of a hiding young she immediately looks for it, runs to it and suckles it. When the female approaches, the young hare runs towards her. The young hare usually begins to move towards its mother when she is 2-3 m away. P.A. Manteifel' noticed that females suckle not only their own young but also other animals who leave tracks. Only after 2-4 days do the young hares leave the lair. The duration of the rest period depends on the quantity of milk obtained. When young hares are taken by men, they cry loudly. The female does not actively protect her offspring. However, she runs past and hits the ground with her hind legs, as do rabbits. On the eighth or ninth day the young hares already begin feeding on grass. Later on, the female suckles her young not more than two or three times.

The female eats the placenta immediately after birth. P.A. Manteifel' writes: "By eating the placenta the mother sets the young free. This act is useful for the mother and for her offspring. Flesh is an unusual food for the hare, and causes diarrhea. This is necessary because in the last days of pregnancy the large fetuses compress the intestine which becomes blocked with feces. If the placenta had not been eaten, it would have decomposed and the odor would have attracted predators, which might have found the young and killed them."

The female can be fertilized again immediately after giving birth. The short northern summer is exploited so that not a single hour is wasted for reproduction.

P.A. Manteifel' describes birth and postnatal events as follows: "We observed a female in the Zoological Garden which gave birth after 50 $^1/2$ days of pregnancy. We saw a wet young hare, energetically crawling out from
227 under her belly. The newborn raised its head trying to get hold of the teat. It sought it by smell and with its lips. At the same time the female turned over and with her teeth pulled another young one from her vagina. The newborn was in a thick layer of membranes. The female tore the membranes and swallowed them in large pieces. After freeing the young one she licked it. The newborn disappeared under her belly and made smacking sounds with its lips. Two more were born, and disappeared under the mother's belly. A large male was sitting near the female. This male tried to copulate with the female already during birth, and once she even assumed her copulating posture. When the female raised herself on her legs and curved her back the three young did not cease sucking and remained almost suspended in the air. Copulation did not take place because the fourth young covered with bloody membranes was still protruding from the vagina. The male jumped off and sat nearby while the female extracted the bloody mass with her teeth. Holding it with her forelegs, she tore the membranes and swallowed them. Her mouth still bloody with the membranes, she rose on her legs and curved her back. The male jumped onto her and copulated. There was only little bleeding during birth. The whole process lasted about five minutes, including the copulation attempt."

D.I. Aspisov (1936) provides interesting data on the growth of the young. This is particularly rapid in later litters, so that they become strong enough to resist the beginning of the cold. This is clearly illustrated by a comparison of weight increase of the young of different litters. From 11 July to 31 August the weight of a leveret of the second litter increased by 80.3 % while that of a specimen of the first litter increased by only 52.0 % during the same period. From 11 July to 30 October the weight of a leveret of the second litter increased by 88.3 % as compared to 65.8 % in a specimen of the first litter.

MOLT. All authors who wrote on the molt of the blue hare agree about the spring molt. However, data about the autumn molt are contradictory.

Loewis* suggested that in autumn the hair of the blue hare grows and becomes depigmented instead of having a true molt. I came to the same conclusion after examination of large series of central Russian blue hares (S.I. Ognev. "Mammals of the Moscow Province" (Mlekopitayushchie Moskovskoi gubernii), 1913, pp. 306-307). I. V. Zharkov recently came to the same conclusion ("Fur Structure and Autumn Molt of the Blue Hare" (stroeniyi mekha i osennyaya lin'ka zaitsa belyaka), Raboty Volzhsko-Kamskoi biologicheskoi stantsii, Vol. I, 1931, pp. 153-167). He thinks that the autumn molt consists of the following stages: 1) appearance of new hair bulbs and renewed activity of old bulbs; 2) growth; 3) depigmentation.

P. A. Manteifel' (1935) made experiments in the Zoological Garden to determine whether the fur of the hare becomes depigmented in autumn or whether the fur is replaced by new hair during the molt. He wrote (1935): 228 "We observed that the hares became white, and asked ourselves whether the gray summer fur is replaced by new white fur, or whether the summer fur persists wholly or in part, losing its dark pigment. In order to determine this the following method was used. In July, two blue hares in summer fur were dyed with henna and hydrogen peroxide. As a result the fur became rust colored. In the middle of November the hares became completely white. We then examined the dyed animals. Much dyed hair persisted under the very long white fur which completely concealed the short summer fur. It thus appears that most of the summer fur (mainly the undercoat) is retained towards winter and its length remains almost unchanged."

This seems a strange conclusion, which in our opinion does not follow from the results of the experiment. Some of the summer fur (undercoat) was certainly retained by these hares when they were examined. However, after the end of the molt it would probably have been completely replaced by winter fur.

In the recent edition of Brehm's Tierleben revised by L. Heck** we find that the fur of hares in the Berlin Zoological Garden was dyed with aniline dyes. These experiments showed clearly that blue hares have a normal autumn molt without depigmentation. J. Allen (1894) and Professor E. Lönnberg (who wrote to L. Heck) came to the same conclusion.

Molt in the blue hare was recently studied by B. A. Kuznetsov and E. A. Pavlova.

They write: "It was thought until recently that the sharp color and structural changes of the fur in autumn were caused by its depigmentation, by its growth and by the appearance of a new undercoat. These changes were not thought to be due to replacement of summer fur by winter fur.

"Our work consisted of the following steps: 1) observation of light specimens in the Moscow Zoological Garden; 2) morphological and histological studies of the pelts of animals from various regions of the U.S.S.R.; 3) dyeing of summer fur of light specimens. We proved that the former notions on autumn changes in structure and color of the fur were erroneous. Our conclusion that the hair is completely replaced in

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* O. von Loewis, Bemerkungen über den Schneehasen Livlands. Zoologisch. Garten, 1877, S. 16-20.

** Brehm's Tierleben, Säugetiere, Bd. II, 1914, S. 68.

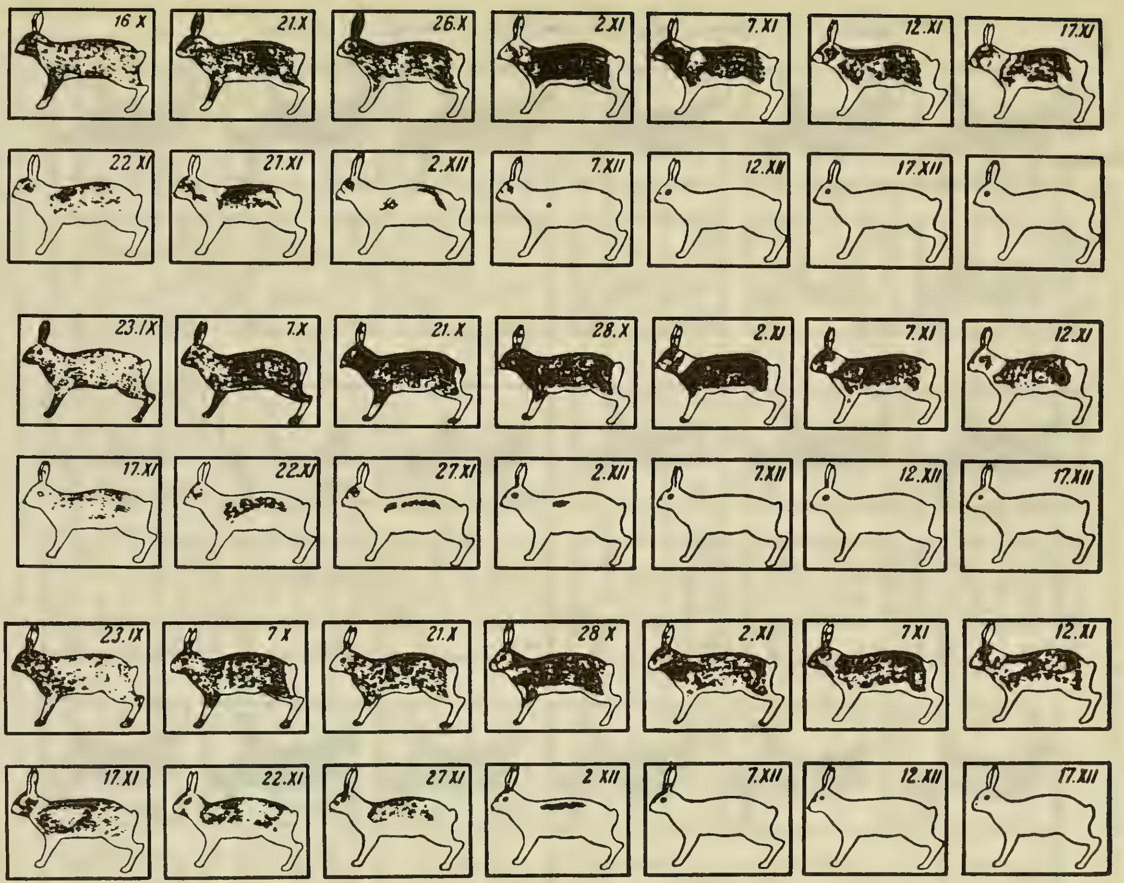
16 X
21.X
26.X
2.XI
7.XI
12.XI
17.XI
22 XI
27.XI
2.XII
7.XII
12.XII
17.XII
23.IX
7.X
21.X
28.X
2.XI
7.XI
12.XI
17.XI
22.XI
27.XI
2.XII
7.XII
12.XII
17.XII
23.IX
7 X
21.X
28 X
2.XI
7 XI
12.XI
17.XI
22.XI
27.XI
2 XII
7.XII
12.XII
17.XII

FIGURE 117. Diagram of autumn molt of the blue hare (after D. I. Aspisov)

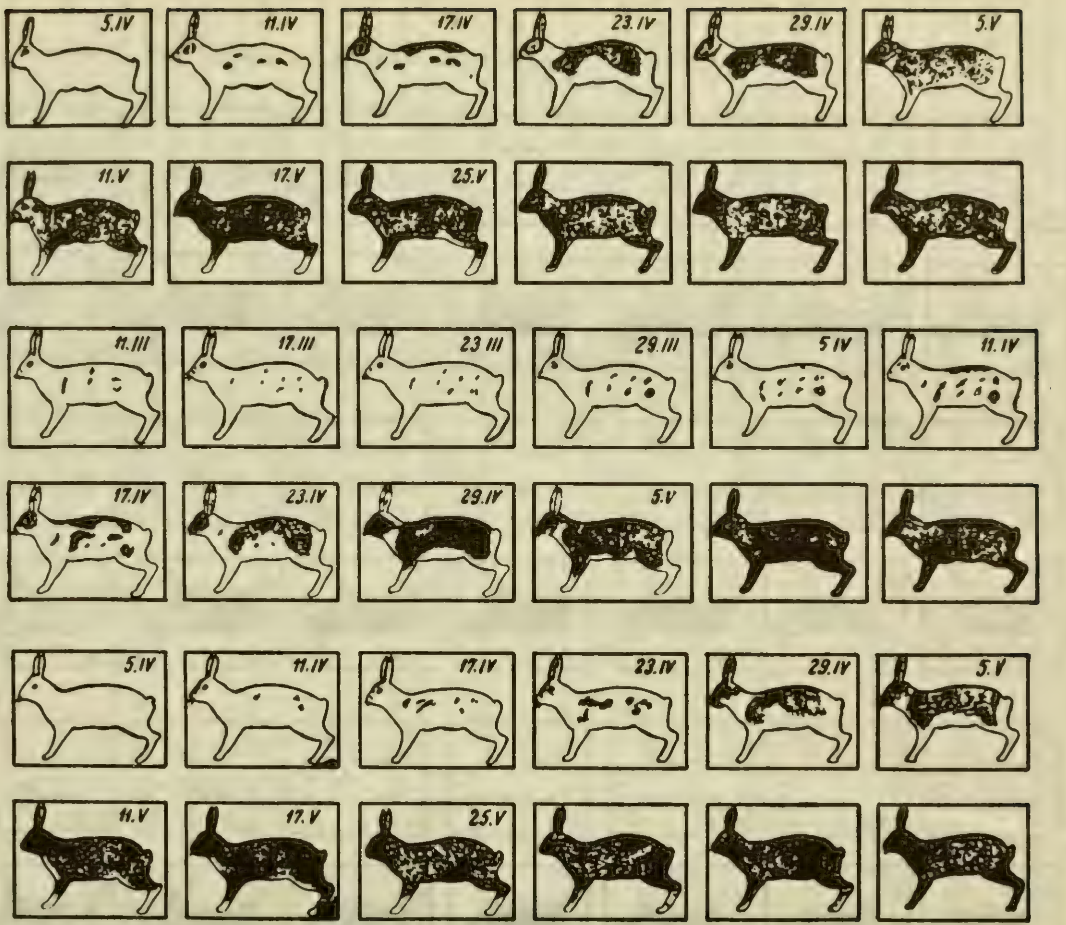
5.IV
11.IV
17.IV
23.IV
29.IV
5.V
11.V
17.V
25.V
11.III
17.III
23 III
29.III
5 IV
11.IV
17.IV
23.IV
29.IV
5.V
5.IV
11.IV
17.IV
23.IV
29.IV
5.V
11.V
17.V
25.V

FIGURE 118. Diagram of spring molt of the blue hare (after D. I. Aspisov)

autumn was based on the following:

1. Some parts of the fur were dyed with permanent colors in midsummer. During the autumn molt the colors became gradually paler and had disappeared completely at the end of November.

2. The length of dark hair was measured every five days between 1 October and 15 November. It was found that the length of the hair is 229 constant and that the hair does not grow.

3. The hair of summer fur of animals caught in July-August always had a keratinized, bulbous root with an occluded cordiform canal. This proves that growth in autumn could not have taken place.

4. We never found partly depigmented hair in autumn fur. The latter always included summer hair which had retained its dark color.

5. The number of white hairs per surface unit growing in autumn usually corresponded exactly to the number of hairs on the same area in the completed winter fur.

6. When pelts of animals shot in autumn are combed, the dark colored hair falls out easily.

7. The structure of summer and winter fur is different in the blue hare. We never found summer hair in the winter fur.

230 "All this proves that the fur of the blue hare is completely replaced during the autumn molt, as in other animals."

Molt takes place in a definite sequence. The white winter fur appears in the following sequence (Figure 117): on the tail, the hind legs, posterior part of back (behind the sacrum), the upper parts of the ears, forefeet, chest, neck, flanks, and head, behind the eyes. The following parts molt later: back, forehead, sides of the head (especially tip of the nose), cheeks and the area below the eyes.

The spring molt begins slowly, but then becomes very rapid (i.e., the fur falls out in whole tufts). It proceeds from the head towards the hindquarters. The summer fur appears first on the anterior part of the head, then on the ears, upper part of back, and flanks. It appears latest on the lower part of the back and the feet. Molting takes place diffusely and 231 uniformly. According to D.I. Aspisov (1936), the spring molt (including the very first slow stage) lasts about three months. According to the locality, the spring molt begins in March-April, and even in May. In the extreme north of Siberia, e.g., in the lower reaches of the Yenisei, Taz and along the Kolyma, it begins in the middle of summer. There occur blue hares in mid-June which have not yet completed their spring molt and do not have complete summer fur.

I examined a series of Kolyma blue hares obtained by S.A. Buturlin. In No.7 (female, 7 June 1905), I found tufts of white fur on the cheeks, occiput and upper part of the neck. Tail, feet and throat (except for a gray transverse stripe on the throat) were white. In No.4 (male, 4 June 1905), caught near the village Pokhodskoe, remnants of the winter fur were even more numerous, covering most of the head and forming large white patches on the back, flanks and legs. The fur of these specimens appeared as if at the height of the spring molt. Together with such specimens occur hares (No. 2, female, 4 June 1905) which have an almost complete dark summer fur. The molt occurs last on the feet. In specimen No. 2 (female) the feet are completely white.

In hares of the extreme north, some parts of the body have hardly enough time to complete their molt into summer fur. For example, in blue hares obtained by L.A. Portenko near Markovo (Anadyr Territory) on 5-7 July 1932, the hind legs and tail are still completely white.

Autumn molt in the Moscow Region begins in the middle of September and ends in December. The time of completion of the molt varies considerably in different specimens, depending on age (old specimens molt earlier) and on the individual. The hares begin molting normally even in snowless late autumn and early winter. They are then in a very disagreeable situation. Their white fur is very conspicuous on the dark grass, when the frightened animal moves among the leafless shrubs.

Farther north the autumn molt begins much earlier. In specimen No. 3 (old, 3 September 1935) of the series of Kolyma blue hares collected by S.A. Buturlin, there is white hair on the ears and on the lower part of the back. In No. 8 (3 September 1905) the ears are almost completely white and there is much white hair on the flanks, the anterior part of the head and the hind part of the back. A hare caught along the Kureika river by F.F. Shillinger on 25 July 1925 (S.I. Ognev's collection No. M. 3176), had clearly begun its autumn molt. White hair had appeared on top of the head, ears, flanks and in some places on the back; feet completely white. Many Khatanga specimens (collected by A.F. Chirkova in August) had begun molting. Summer fur is thus worn by blue hares of the extreme north only for a short period, little more than two months.

POPULATION DYNAMICS AND MIGRATIONS. The blue hare population of a locality is not constant but is subject to considerable fluctuations. 232 Both in Russian and foreign literature there are many reports on the large scale of these fluctuations, and the factors regulating them are discussed.

These data have been summarized recently by A.N. Formozov. ("Population Dynamics of Commercial Animals" (Kolebaniya chislennosti promyslovykh zhivotnikh), Moscow, 1935, pp. 12-32). After analyzing data from the literature and discussing observations by correspondents, A.N. Formozov comes to the following conclusions. The increase and decrease in populations of hares recur periodically and regularly. The rhythm of 233 fluctuations remains the same for large regions with similar physico-geographical conditions. In the south and southwest of Russia the fluctuation cycles are short, recurring every five years. These periods become longer farther north. In the Leningrad Region the cycle lasts 5-6 years; in Karelia 9; in Yakutia 9 years or even more."

American naturalists also observed a periodicity in the fluctuation in numbers of Lepus americanus. Ch. Elton (1924) compared the cycle of the American hare (every 10 years) with the sunspot cycle. In his opinion, the peaks of populations coincide with years with a minimum of sunspots. This, however, seems inexact because there are exceptions to this rule. Elton's conclusion therefore seems hardly justified.

To illustrate the scale of fluctuations of the populations we give a few examples of mass reproduction. Some regions become overpopulated and the hares begin migrating. M. Sulima (1911) describes such a migration in a "fertility year": "In the autumn of 1908 a large migration of hares from the east to the west was observed in the former Vologda and Arkhangelsk provinces. The hares proceeded in masses, feeding on their way on haystacks, aspen thickets, etc. In the Vychegda District they destroyed so much hay that they caused considerable damage. Hares were caught by all methods along the Pechora river in that year. The hunters did not have time to lay traps. In M. Sulima's village 150 sled dogs lived only on hares during the whole season. In the winter of 1909-1910, the number of hares fell off markedly. None of the hares shot during this season were young. The young apparently had died, and multiplication decreased.

A.N. Formozov's correspondent wrote that hares (apparently mainly blue hares) were unusually numerous in the Kamyshlov District in December 1921. Aspens, birches and willows 1.5 cm thick were eaten completely. No guns were used. Hares were caught with nets. Groups of 25 people covered distances of 200 m with nets and caught as many as 80 hares each time.

Mass multiplication and migrations have been described also from Siberia (M. Konstantinov, "Fur Trapping and Fur Commerce in the Yakutsk Territory" (Pushnoi promysel i pushnaya torgovlya v Yakutskom krae), 1921; N.N. Beretti, "In the Extreme Northeast" (Na krainem severo-vostoke), 1929, etc.).

After studying recent statistics A.N. Formozov came to the conclusion that the number of pelts treated in "productive years" may be 50 or more times as large as the number of pelts obtained in "poor years" in the Ivanovo Region, 25 times as large in Karelia, 20 times as large in the Western
234 and Leningrad regions, 35 times as large in the Moscow Region, etc. The amplitude of the fluctuations is thus very large.

There are many causes for the increase of numbers. In A.N. Formozov's opinion, one of the main causes is the natural purification and disinfection of land in the 2-3 years after epizootics, during which the population of hares is very small. After populations of hares have been very high, there are large numbers of oocysts of coccidia and eggs of parasitic helminths in the soil. This results in epidemic outbreaks which cause mortality among the hares. However, the parasites apparently die in 2-3 years. Hares which survive the epizootic are apparently immune to infection. The survival rate of the young is certainly increased in the area in which the pathogens have disappeared.

Another important factor is the increased fertility of females at the beginning of a "productive" year. MacFarlan observed for Lepus americanus that in productive years the number of young per litter increased from 3-4 to 6-8 (or even 10). One of the prerequisites for mass multiplication is favorable food and climatic conditions, e.g., sufficient food in winter, a low snow cover, etc. A deep snow layer would have covered the young shrubs growing after a year with a high population of hares.

Two related factors cause increased population: abundance of food and increased fertility of females.

As stated above, peaks of blue hare populations have a definite periodicity, the intervals of which increase towards the north, because as a result of the short summer the blue hares in the north have fewer litters in summer than do the hares in the south, where the summer is longer and hotter and the autumn warm and prolonged.

Among the main factors which reduce populations are epizootics. The denser the population of a species, the quicker epizootics spread.

A.N. Formozov (1935) writes: "The scale and course of an epizootic depend on the following factors: 1) the population of hares; 2) climatic conditions; 3) presence of disease carriers and vectors of parasites; 4) landscape features (especially characteristics of the soil). The disease

appears first in separate, small foci. These expand rapidly, encompassing
235 progressively larger areas until they become confluent, leaving only small healthy islands in which small numbers of hares survive after the animals around them have been killed by the epizootic. Such "islands" have been repeatedly observed by hunters during recent large epizootics. They were generally located on isolated, high and dry plots in which the population of hares was moderately dense." A.N. Formozov collected material on the great "plague" of hares which occurred between 1926 and 1930. This epizootic broke out with great violence in the south, mainly among common hares. As the plague moved northward, it also began to affect populations of blue hares.

In 1928-1929 reports were received on mortality of hares in the Ukraine, the central Chernozem Region, Belorussia, the Urals, the former Saratov and Stalingrad territories, Moscow, Ivanovo and Western regions. Isolated reports came also from the Northern and Nizhni Novgorod (Gorki) territories. In 1929-1930 the plague had ceased in the south and on the Urals, where, after reaching its minimum, the population of hares again began to increase. The epizootic occurred in the northern area and in the Leningrad Region in 1929-1930, continuing in these areas during 1930-1931. The decrease of hares was irregular during these years. It was especially marked during the second year of the epizootic.

The victims of the epizootics are very numerous. A.N. Formozov (1935) reports that in the spring after the 1929 plague in the Shar'ya District of the Nizhni Novgorod Territory, when rubbish was being burned in felling areas, a number of blue hares, still covered in winter fur, were found in each plot.

Mortality of hares is also increased by the following factors: 1) deep snow; 2) snow storms; 3) strong frosts; 4) ice-covered soil; 5) rainy summers.

One of the important parasites of hares during plague years is the liver fluke (Fasciola hepatica). The hares also contract strong infections of Taenia serrata. Tens of thousands of larvae of this parasite (oncospheres) are deposited with feces on the ground and among the grass. They are then ingested with the food.

A dangerous lung parasite of the hares is the helminth Synthetocaulus commutatus. According to M.P. Liubimov (1935), epizootics of Synthetocaulus are very severe in rainy years in low and humid pasturelands. Strong infections with this parasite cause symptoms of pneumonia with frequent coughing and sneezing. The presence of 50-100 worms in the lungs of a hare produces a pathological picture of pneumonia.

Trichostrongylosis caused by Trichostrongylus retortaeformis and T. instabilis is very common in hares. Infected hares are emaciated, anemic, and have chronic intestinal catarrh.

The liver of the hares is often parasitized by Linguatula taenioides (Pentastomida).

236 According to M.P. Lyubimov (1935), about half the hares suffer from coccidiosis. Eimeria stiedae infects the liver and Eimeria perforans and E. magna, the intestine.

More information about diseases of hares is given in M.P. Lyubimov's "Diseases of Squirrels and Hares" (Bolezni belok i zaitsev), in "Biology of Hares and Squirrels" (Biologiya zaitsev i belok), pp. 80-140, Moscow, 1935.

The blue hares cause damage to forest nurseries, undergrowth and shrubs. They damage trees by gnawing rings around the trunk. Young trees suffer severely during years of mass multiplication of hares. The blue hares often damage gardens and melon fields.

The blue hare is hunted by foxes, lynxes and wolves. It is also attacked by smaller predators such as ermines and weasels which kill mainly young hares. According to I.I. Kolyushev (1936), the polar fox usually does not attack the blue hare. It does not attack a hare which is lying down nor does it drive it from its lair. The following predacious birds hunt hares: eagles (e.g., golden eagles), goshawks and great horned owls.

The greatest enemy of the hares is man, who hunts them for their meat and fur.

COMMERCIAL VALUE. Pelts of hares are of great commercial value. They are used for fur articles and are also shorn and dyed for the manufacture of felt. Pelts of hares are an important article of Russian export.

Before the revolution about 6 million pelts of hares of all species were processed in Russia.

Modern stocks of pelts of blue hares are subject to great fluctuations depending on "productive" years of the hares. According to B. A. Kuznetsov (1932), the stocks of pelts may range between 100 and 502% during six years. The number of pelts of blue hares constitutes 1.2-6.1% of the total fur production of the U.S.S.R.

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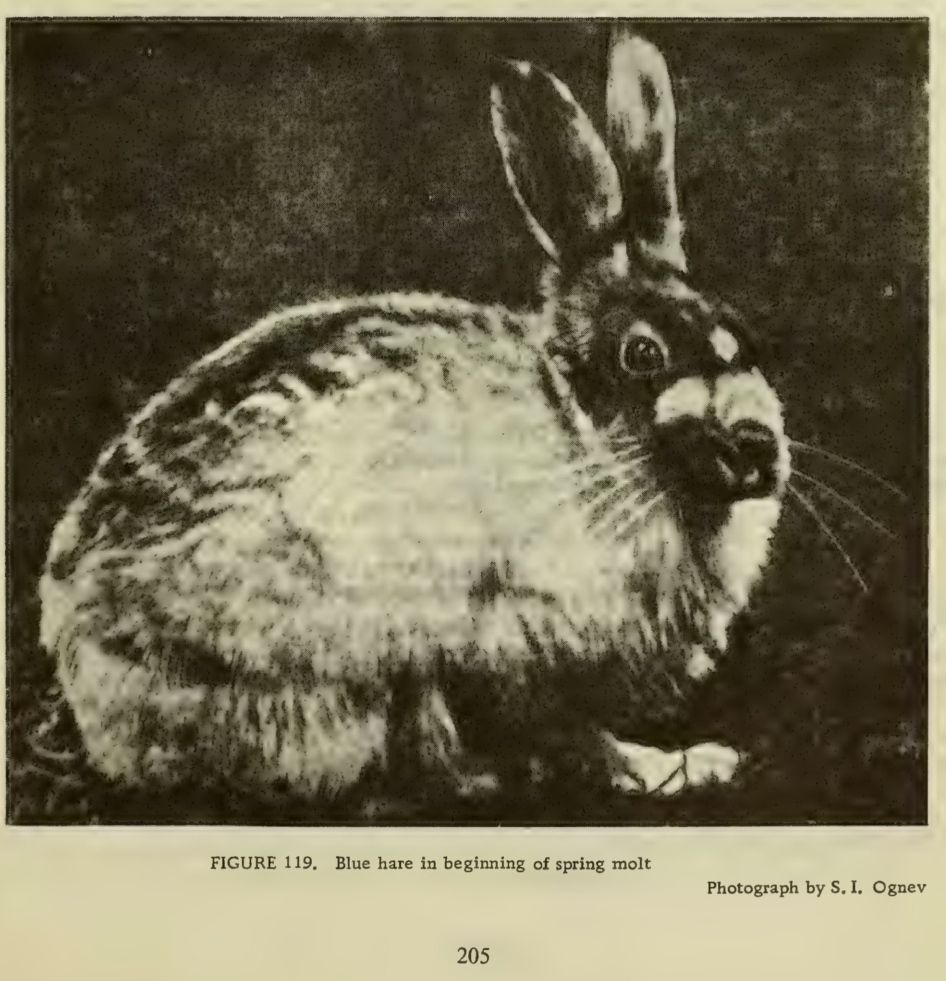

FIGURE 119. Blue hare in beginning of spring molt

Photograph by S. I. Ognev

KEY TO SUBSPECIES OF THE BLUE HARE (LEPUS TIMIDUS L.) IN THE U.S.S.R.

1 (8). Anterior inner margin of ears black or black-brown.

2 (5). Skull massive; zygomatic bones wide; length of skull 98-116 mm (M. 103 mm); zygomatic width 51-57 mm (M. 52.8 mm).

3 (4). Summer fur on back dull grey-brown-straw-colored with a little blackish mottling. Lower part of back grayer than middle, ash-gray. Anterior inner margin of ears with marked blackish tones; its color clearly different from that of back.

L. timidus tschuktschorum Nordquist.

4 (3). Color of summer fur on back pale gray. Lower part of back gray with an ash-blue tinge. Anterior inner margin of ears pale gray with a slight rust tinge.

L. timidus begitschevi Koljuschev.

5 (2). Skull less massive and zygomatic bones narrower; length of skull about 100 mm, usually less; zygomatic width usually less than 50 mm.

237 6 (7). Anterior inner margin of ears black-brown with slight straw-rust mottling. Measurements large: length of skull 95.2-101.7 mm (M. 97mm); zygomatic width 48-50.8 mm (M. 49 mm). Weight about 4 kg or more.

L. t. timidus L.

7 (6). Anterior inner margin of ears usually black. Length of skull 88.7-99.2 mm (M. 96.6 mm); zygomatic width 45-50 mm (M. 49.3 mm). Weight usually less than in L. t. timidus, about 2.7-3.1 kg.

L. t. kolymensis Ognev.

8 (1). Anterior inner margin of ears not black or black-brown, but of lighter color.

9 (10). General color of back rich rust-brown. Anterior inner margin of ears rust-brown.

L. t. kozhevnikovi Ognev.

10 (9). General color of back not rich rust-brown. Anterior inner margin of ears not rust-brown.

11 (12). Color of back of light and dull color: straw-earth-gray or dull gray.

Color of summer fur on back dull, light straw-earth-gray without any rust tone or light straw mottling. Color of lower part of back not markedly different from that of other parts of the back.

Anterior inner margin of ears dull straw-earth-gray, their color not different from color of back.

L. t. sibiricorum Johansen.

12 (11). Color of back brownish gray.

13 (14). Color of lower part of back in front of tail deep gray, clearly different from color of other parts of the back. Color of back dark chestnut-brown-gray with a marked black tone. Anterior inner margin of ears brownish gray, sometimes with blackish and slight straw tone.

L. t. gichiganus J. Allen.

14 (13). Color of lower part of back in front of tail light gray with a brown tone, not sharply different from that of other parts of the back.

Color of back lighter than in L. t. gichiganus, between rust-brown with straw and gray mottling to duller, more brownish tones with a slight straw-gray and blackish gray mottling. Color of anterior inner margin of ears not sharply different from that of back.

15 (16). Measurements small: length of skull 86-93.2 mm; zygomatic width 45-49 mm. Length of body 440-515 mm; hind feet 132-152 mm.

L. t. transbaikalicus Ognev.

16 (15). Measurements large: length of skull 88-96 mm; zygomatic width 47-51 mm. Length of body 523-570 mm; hind feet 155-180 mm.

L. t. mordeni Goodwin.

340. Lepus timidus timidus Linnaeus (1758). Northern blue hare

1758. Lepus timidus Linnaeus C., Systema Naturae, editio 10, p. 57.

1777. Lepus timidus alpinus Erxleben J. Ch., Systema regni animalis per classes, ordines, genera etc., Mammalia, I., p. 328.

1778. Lepus variabilis Pallas P. S., Novae species quadrupedum e Glirium ordine, pp. 1-17.

1778. Lepus algidus Pallas P. S., op. cit., p. 2 (NewName for the Alpine hare, Thomas Pennant, British Zoology, IV, 1770, p. 40).

1778. Lepus borealis Pallas P. S., op. cit., p. 2.

238 1795. Lepus septentrionalis Link H. Fr., Beiträge zur Naturgeschichte, Rostock, B. II, p. 73.

1816. Lepus albus Leach W. E., Systematic Catalogue of the Specimens of the Indigenous Mammalia and Birds that are Preserved in the British Museum, p. 7 (Nomen nudum!).

1819. Lepus albus Leach W. E., in Sir John Ross's Voyage of Discovery, editio I, app. II, pp. XLV-XLVI; editio II, Vol. II, app. IV, pp. 17, 170 (Nomen preoccupatum!). Bechstein J. M., Gemeinnützige Naturgesch. Deutschlands etc., 1801, editio I, Vol. II, S. 1096 (Lepus timidus albus from Thüringia).

1820. Lepus borealis Nilsson S., Skandinavisk Fauna, Lund, B. I, p. 211.

1829-1832. Lepus borealis collinus Nilsson S., Illuminerade Figurer till Skandinav. Fauna, Lund, I, pl. 16, 19.

1829-1832. Lepus borealis sylvaticus Nilsson S., op. cit., I, pl. 22.

1844. Lepus canescens Nilsson S., Öfversigt af Kongl. Vetensk. Academ. Förhandl., Stockholm, I, p. 133.

1884. Lepus variabilis Pleske Th., Übersicht der Säugethiere und Vögel der Kola-Halb., 1884, S. 108-111.

1906. Lepus medius scoticus Hilzheimer M., Zoologischer Anzeiger, XXX, S. 511.

TYPE LOCALITY AND DEPOSITION. In the tenth edition of "Systema Naturae" we find the following: "Habitat Europa. Hyeme in frigidis niveus exceptis auribus nigris". The type locality is not given. G. S. Miller (1912) proposes to consider the vicinity of Upsala as the type locality of the nominate race. Holotype not preserved.

MATERIAL EXAMINED: 12 pelts and 13 skulls.

DIAGNOSIS. In summer fur anterior part of muzzle, cheeks and forehead dull brownish gray-rust-colored. A considerable admixture of blackish hair on the upper part of forehead, vertex and between the ears. These parts of the head therefore appear duller and darker.

Color of back dark, dull brownish gray with a delicate pattern of straw-gray and blackish gray mottling. Anterior inner margin of ears black-brown with slight straw-rust mottling. A dull grayish brown (hair-brown) stripe across the chest. Winter fur completely white, underfur white, hair not very luxuriant, soft or silky.

Length of skull 95.2-101.7 mm (M. 97 mm); zygomatic width 48-50.8 mm (M. 49 mm).

Length of body 590-600 mm; hind feet 155-164 mm (M. 158.6 mm); ears (measured along concavity) 84-94 mm (M. 89 mm).

SYSTEMATIC NOTES. Typical northern blue hares are characterized as follows: 1) rather dark brownish gray summer fur; color of back mixed with hair-brown and sepia; flanks with grayer tones (hair-brown and mouse-gray) 2) black-brown color of anterior inner margin of ears; straw-rust-colored mottling on the background of this dark color.

In spite of variations of the general color the dull gray color of the summer fur may be considered as typical for L. t. timidus.

Winter fur with snow-white undercoat.

Not only specimens from the north of the European part of the U.S.S.R. belong to the nominate race of the blue hare, but also some from the
239 northern part of the Tobolsk Territory, e.g., from near Surgut and Narym. Specimens which are transitional to the western Siberian lighter race, L. t. sibiricorum Johans. occur in Narym.

Owing to the courtesy of the late Professor G. E. Johansen I had the opportunity of examining the holotype of L. lugubris Kastsch.* obtained on 20 June 1928 near Ongudai on the Altai. A second specimen (cotype) was caught along Um'gumen' river on the Altai.

A comparison of Lepus lugubris with typical blue hares showed that they are closely related. It is almost impossible to distinguish lugubris from the nominate race of the blue hare.

Comparison of series showed the following differences between Lepus t. timidus and L. lugubris Kastsch: 1) general color of fur of the Altai hare with a stronger straw tone especially on the head; 2) dark color of ears (i.e., black color on anterior inner margin of ears) weaker than in the north European race.

The Altai blue hare is only a natio of the nominate subspecies and it should be named L. t. timidus natio lugubris.

G. E. Barrett-Hamilton (Proceedings Zoolog. Society of London, part I, p. 90, 1900) described the subspecies L. t. altaicus from a single specimen (pelt and skull) in the collection of the British Museum. It is labelled "Altai Mountains". Barrett-Hamilton does not give a description, but only records the basal length of skull and blackness of the ears. If Lepus t. altaicus really came from the Altai Mountains, the blackness of the ears places it with L. t. lugubris, and makes it a synonym of this.

The boundaries of the range of the northern blue hare in western Siberia are not known. Blue hares from Narym are transitional between L. t. sibiricorum and L. t. timidus in some characters. The Narym hares have practically no black anterior inner margins of the ears. Specimens from Tomsk, Novosibirsk and Omsk are typical L. t. sibiricorum. L. t. sibiricorum thus seems to separate the Altai range of L. t. lugubris from that of the nominate subspecies. The ranges of L. t. timidus and L. t. lugubris possibly overlap in a narrow strip beyond the Yenisei Mountains and farther north.

Melanic specimens are very rare among the blue hares. One such specimen obtained on 2 October 1936 near Arkhangelsk was sent to me by V. Ya. Parovshchikov. The color of the guard hair on the back of this specimen is a brilliant black. Undercoat and roots of hair gray. Color of underparts, especially of belly, lighter, whitish gray.

GEOGRAPHICAL DISTRIBUTION. The typical race occurs in Scandinavia, Finland, Lapland, Murmansk Coast, Karelia, Onega Territory, the Valdai Hills, in the Vologda, Kostroma, Vyatka [Kirov] 240 and Perm territories. It is still difficult to establish the southern boundary of the range of the race in this region. It apparently passes near 57-58° N. In western Siberia the nominate race occurs near Berezovo, Tobolsk, Surgut, and Narym. A slightly different form (natio lugubris Kastsch.) occurs on the Altai.

341. Lepus timidus kozhevnikovi Ogn. (1929). Central Russian blue hare

1895. Lepus timidus Satunin K. A., Pozvonochnye Moskovskoi gubernii. Mlekopitayushchie (Vertebrates of the Moscow Province. Mammals), Izvestiya Obshchestva Lyubitelei Estestvoznaniya, antropologii i etnografii, Vol. XXXVI, p. 14.

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* N. F. Kashchenko, Results of the Altai Expedition, Tomsk, 1899, pp. 57-59, tab. II, fig. 4.

240 1913. Lepus timidus Ognev S.I., Mlekopitayushchie Moskovskoi gubernii (Mammals of the Moscow Province), Vol. I, pp. 298-307.

1929. Lepus timidus kozhevnikovi Ognev S.I., Zur Systematik der russischen Hasen. Zoologischer Anzeiger, Bd. 84, H. 1/4, S. 79-80.

TYPE LOCALITY AND DEPOSITION. No. 2368 male, 16 October 1911, near village Chernaya, Bogorodsk County, Moscow Province, collection of the Moscow Zoological Museum.

MATERIAL EXAMINED: 89 pelts and 125 skulls.

DIAGNOSIS. In summer fur, anterior part of muzzle, cheeks and forehead rich rust-brown. Upper part of forehead, vertex and area between ears with some blackish hair. The color of these parts is therefore generally more intense and darker.

General color of back rust-brown with very light grayish black mottling.

Anterior inner margin of ears intense rust-brown, occasionally with a black tinge caused by black-brown hair and black-brown hair tips of the other guard hair.

A broad dull straw-gray stripe (between hair-brown and drab) across the chest, which has a marked straw-rust-colored tone.

Winter fur white. Undercoat with light yellowish roots. Yellowish tone of the hairs of undercoat with a slight rust tinge. Hair of winter fur coarse and less dense and silky than in northern and northeastern forms. Length of hair on back 35 mm; hair on lower part of chest and sides of belly up to 60 mm.

Length of skull (Figures 120, 121) 97.8-105.6 mm (M. 100 mm); zygomatic width 50-53 mm (M. 52.3 mm).

Length of body 450-630 mm; hind feet 155-180 mm (M. 170.8 mm); ears (measured along concavity) 80-100 mm; ears (measured from occiput) 110-118 mm (M. 113.8 mm).

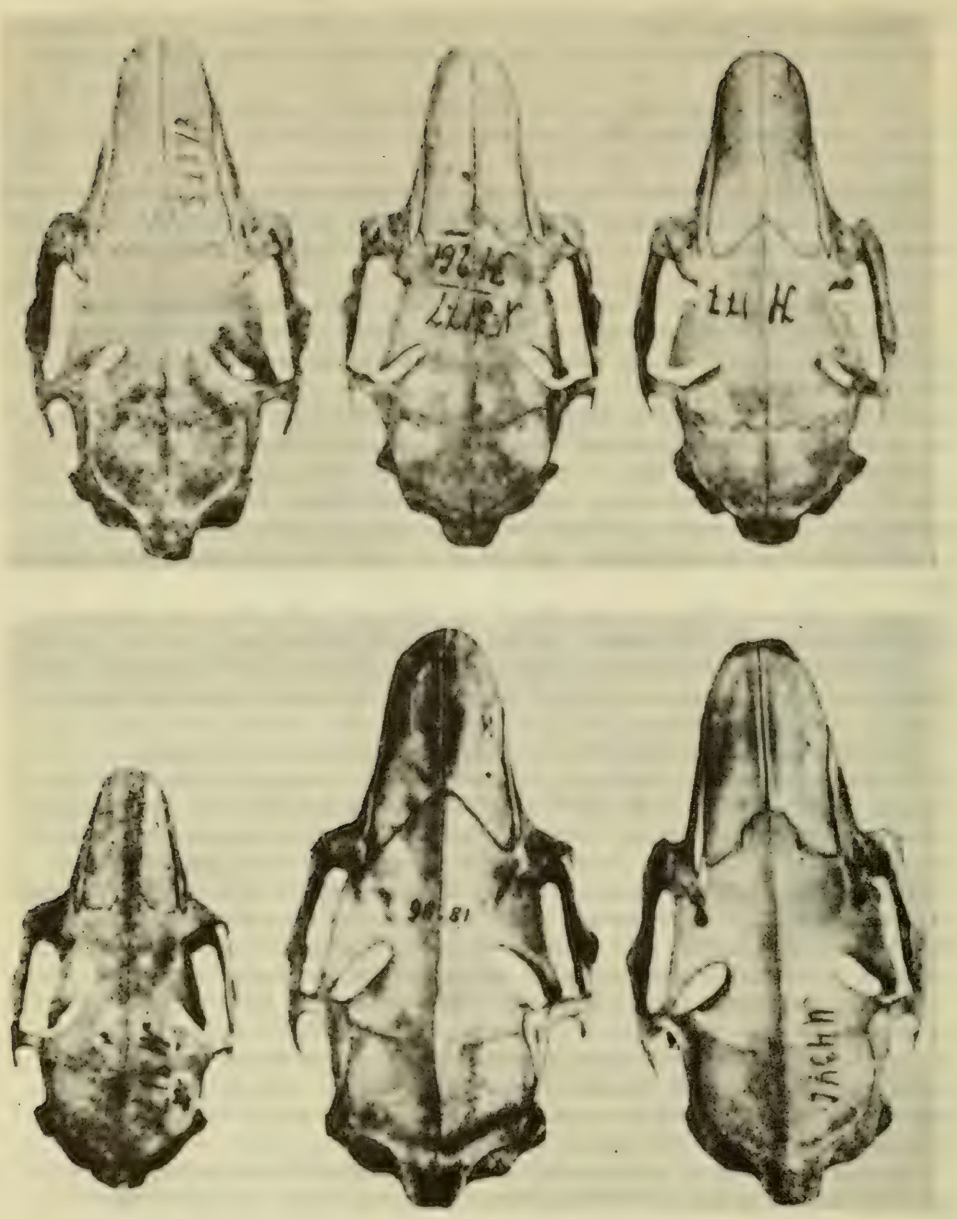
SYSTEMATIC NOTES. The Central Russian blue hare is well differentiated from the northern subspecies; the color of its summer fur is richer. According to N.A. Severtzov (1855), the summer fur of Moscow blue hares is more reddish. The hair of these southern specimens is rust-colored with black rings, which results in a yellow-brown ground color.

I had not enough blue hares from the southern parts of the range in eastern Europe. I mentioned already that towards the south the color of the fur becomes lighter and richer. Moscow blue hares are more reddish and of a richer color than those from Murmansk, Arkhangelsk, etc.

242 Large series should be examined to determine how far south the tendency of southern specimens to have lighter and richer color continues. It seems that even if the Voronezh and other southern blue hares are lighter and richer colored than the Moscow hares, this feature is still transgressive, and not sufficiently well marked. It is still premature to speak of a south European race of the blue hare.

Among series of L. t. kozhevnikovi one finds together with typical specimens, markedly darker specimens from the same locality. For example, on 22 August 1933 in a humid forest in the floodland of the river Belaya (near the village Angasyak in the Dyurtyuli District of Bashkiria, former Birsk County of the Ufa Province), N.E. Schultz shot a male, the color of which was rather dark with the anterior inner margin of the ears black. On the same day I shot in the same forest a female with the normal rich color characteristic of the subspecies kozhevnikovi.

A series of typically colored hares obtained in Bashkiria by S.V. Kirikov included a female (shot on 20 May 1931 in tugais along the river Belaya) which had the anterior inner margin of the ears markedly black.



FIGURES 120-125. Skull of subspecies of *Lepus timidus*. 120 — *Lepus t. kozhevnikovi* Ogn., No. 2343, 23 Oct. 1911 Bogorodsk County Moscow Province, Collection of the Moscow Zoological Museum; 121 — *Lepus t. timidus* natio *lugubris* Kastsch., type No. 3177, 20 June 1898, Altai, Ongudai, N. F. Kashchenko. Photograph by S. I. Ognev; 122 — *Lepus t. sibiricorum* Johans., type No. 4858, Chulym River; 123 — *Lepus t. transbaikalicus* Ogn., type No. M. 3178; 124 — *Lepus t. begitschevi* Koljushev, No. 18786, KZMAN; 125 — *Lepus t. tschuktschorum* Nordquist, No. M. 4346, S. I. Ognev's collection, from the Chukot Peninsula. Photograph by S. I. Ognev.

GEOGRAPHICAL DISTRIBUTION. The southern and southwestern boundaries of the range of this race are the same as the southern boundary of the range of the blue hare in eastern Europe.

The northern boundary of the range is not quite clear. However it coincides with the southern boundary of the range of the typical race (see above). Richly colored blue hares occur in the Baltic Region, near Yamburg, Peterhof and Novaya Luga. That is, hares colored like L. t. kozhevnikovi occur in the western parts of the Leningrad Region and apparently near Leningrad. All specimens from the region examined belong to this subspecies. Hares from the Valdai Hills in the former Novgorod Province belong to L. t. timidus.

In the northwestern part of the U.S.S.R., the range of L. t. kozhevnikovi reaches farther north than in the central parts of the European part of the U.S.S.R.

It is difficult to state where this subspecies disappears in the east. Turgai specimens are much more closely related in color to L. t. sibiricorum* than to L. t. kozhevnikovi. Hares from the southern Urals and Bashkiria belong to the central Russian form.

342. Lepus timidus sibiricorum Johans. (1923). West Siberian blue hare

1877. Lepus variabilis Peters W., Übersicht über die während der Sibirisch. Expedition von Dr. Finsch gesamm. Säugethiere, Monatsberichte der Königl. Akadem. der Wissensch. z. Berlin, S. 735 (Samarovo on the Irtysh).

243 1886. Lepus variabilis Stepanov P., Zoogeograficheskii ocherk lesisto-bolotistoi polosy mezhdu rek Om'yu, Taroi i Irtyshom (A Zoogeographical Survey of the Forest-Marsh between the rivers Om', Tara and Irtysh), Zapiski Zapadno-Sibirskogo otdeleniya Geograficheskogo obschestva, 8 (1):25-38.

1923. Lepus timidus natio sibiricorum Johansen G. E., Po Chulymu (Along the Chulym), Izvestiya Tomskogo gosudarstvennogo universiteta, p. p. 58-59.

1923. Lepus timidus Martino V. and E., Materialy po sistematicheskomu i geograficheskomu rasprostraneniyu mlekopitayuschikh Kirgizskoi stepi (Material on the Systematic and Geographical Distribution of Mammals in the Kirghizian Steppe), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXIV, p. 29 (Semipalatinsk Region).

1925. Lepus timidus Zverev M. D., Obzor gryzunov Kuznetskoi stepi (A Survey of the Rodents of the Kuznetsk Steppe), p. 133.

1928. Lepus timidus Shukhov I., Promyslovye zveri Tarskogo okruga (Fur Animals of the Tara District), "Okhotnik" No. 7, p. 22.

TYPE LOCALITY AND DEPOSITION. Western Siberia, valley of Chulym. Type No. 4858 female, 7 January 1914, river Chulym, Artarek Island, near village Novokuskovo, G. E. Johansen, collection of the Zoological Museum of the Tomsk University.

MATERIAL EXAMINED: 17 pelts and skulls.

DIAGNOSIS. In summer fur, color of anterior part of muzzle, cheeks and forehead pale and dull straw-rust-gray; general color of these parts much duller and more yellow than in Moscow blue hares, between avellaneous and cinnamon.

Color of upper part of forehead and vertex duller and darker because of a slight admixture of blackish tips of some hairs.

Color of back dull and light straw-earth-gray without any rust tinge.

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* After comparing series of L. t. sibiricorum with hares from Kustanai, I found that their color is richer than that of typical sibiricorum. However they do not have the rust tones of L. t. kozhevnikovi. Some specimens are more closely related to L. t. timidus.

Color of anterior inner margin of ears straw-earth-gray, not different from general color of back.

A broad dull straw-gray stripe across the chest. Hair tips in this region whitish straw.

Winter fur white; undercoat completely white.

Length of skull (Figures 122, 128) 92.3-100.2 mm (M. 98.2 mm); zygomatic width 46.7-53.2 mm (M. 49.7 mm).

Length of body 433-550 mm; hind feet 145-155 mm (M. 152.1 mm); ear (measured along concavity) 86-92 mm; ear (measured from occiput) 104-117 mm (M. 110.3 mm).

SYSTEMATIC NOTES. This subspecies is clearly distinguished from the central Russian blue hare by the following characters: 1) light earth-straw-gray color of back without any admixture of reddish rust color; 2) color of head much lighter straw-rust-gray; 3) color of ears pale straw-earth-gray.

The West Siberian blue hare differs even more sharply from the nominate race than from L. t. kozhevnikovi.

GEOGRAPHICAL DISTRIBUTION. The range of this subspecies is not well known. It occurs mainly in the plains of western Siberia. It is widely distributed in the Tomsk Territory. The northern boundary of its range passes between the Chulym and Tara rivers. In the south it occurs as far as Abakan, Semipalatinsk and farther south to the Samara District (south of the Kalba Range). This record is very interesting. I have a series of hares identical with true sibiricorum, which were collected in the Samara District by V.I. Dasenkov. Farther south this subspecies occurs in the Zaisan Depression (specimens in the collection of the Zoological Museum) and also in northern Dzhety-Su (the Lepsinsk, Kopal, 244 Alma-Ata districts). After examination of specimens given by V.N. Shnitnikov to the ZMAN I decided that the Dzhety-Su specimens belonged to L. t. sibiricorum. Its distribution towards the west is still unknown. It occurs in plains from the Zaisan Region towards Akmolinsk [Tselinograd], Atbasar and Kokchetav.

According to N.M. Mikhel' (1934), Lepus timidus sibiricorum occurs in the Borovoye Forestry south of Kokchetav. In his opinion blue hares from the Troitsk District do not differ from sibiricorum. Specimens from the Kustanai District (south of Kustanai, the Naurzum Reserve) are intermediate between L. t. timidus and L. t. sibiricorum, and differ clearly from L. t. kozhevnikovi

The Kustanai-Turgai belt is apparently inhabited by a transitional type, and the ranges of three races meet in this region. As the habitats of the Turgai blue hare are rather specialized (see below) we may assume that this region is inhabited by a separate natio. The boundary of the range of L. t. sibiricorum passes west of the line Atbasar-Petropavlovsk.

343. Lepus timidus transbaikalicus Ognev (1929). Transbaikal blue hare

1910. Lepus timidus Kashtchenko N. F., O kollektsii mlekopitayushchikh iz Zabaikal'ya (A Collection of Mammals from Transbaikalia), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, XV, p. 271.

1926. Lepus timidus Soronov I., Fauna gryzunov v raione Ivanovo-Arakhleiskikh khutorov (Rodent Fauna ih the Region of the Ivanovo-Arakhleiskie Hamlets), in "Regional Studies in Transbaikalia" (K kraevedcheskim rabotam v Zabaikal'e) Izdanie Chitinskogo gosudarstvennogo muzeya, p. 41.

1926. Lepus timidus Svatosh Z. F., Pushnoi i okhotnichii promysel (Hunting of Fur Animals and Fur Trade), in G. G. Doppelmeyer "The Sable Trade Along the Baikal Coast" (Sobolinyi promysel na poberezh'e Baikala), p. 176.

1929. Lepus timidus Kuznetsov B. A., Zverovye promysly vostochnogo Zabaikal'ya (Animal Trade in Eastern Transbaikal), Trudy po lesnomu opytnomu delu, Tsentral'naya lesnaya opytnaya stantsiya, issue VI, p. 92.

1929. Lepus timidus transbaikalicus Ognev S. I., Zur Systematik der russischen Hasen, Zoologischer Anzeiger, Bd. 84. H. 1/4, S. 81.

TYPE LOCALITY AND DEPOSITION. No. M. 3178, 23 December 1924, Sosnovka, Barguzin Taiga, near Lake Baikal, in Transbaikal. S. I. Ognev's collection.

MATERIAL EXAMINED. 12 pelts and skulls.

DIAGNOSIS. In summer fur, anterior part of muzzle, cheeks and forehead dull brownish gray-rust, colored sometimes with an admixture of richer rust color.

A greater admixture of blackish hair on the vertex and between the ears. These parts are duller than the anterior part of forehead and cheeks.

Color of back dark, dull brown with a slight straw-gray pattern and blackish gray mottling. Color of anterior inner margin of ears almost the same as that of back, dull brown with straw-gray and blackish mottling. 245

A dull grayish brown (hair-brown) stripe across the chest. Color of chin and throat of all specimens examined dull gray with a slight brown (light drab) tinge.

Winter fur white, undercoat with a slight yellowish straw tone (at the roots of the hairs). Hair of winter fur more luxuriant, silky and soft. Hair of middle of back 42 mm long; hair of flanks and belly up to 62 mm long.

Length of skull (Figures 123, 129) 86-93.2 mm (M. 90.7 mm); zygomatic width 45-49 mm (M. 46.7 mm).

Length of body 440-515 mm; hind feet 132-152 mm; ear (measured along concavity 77-92 mm.

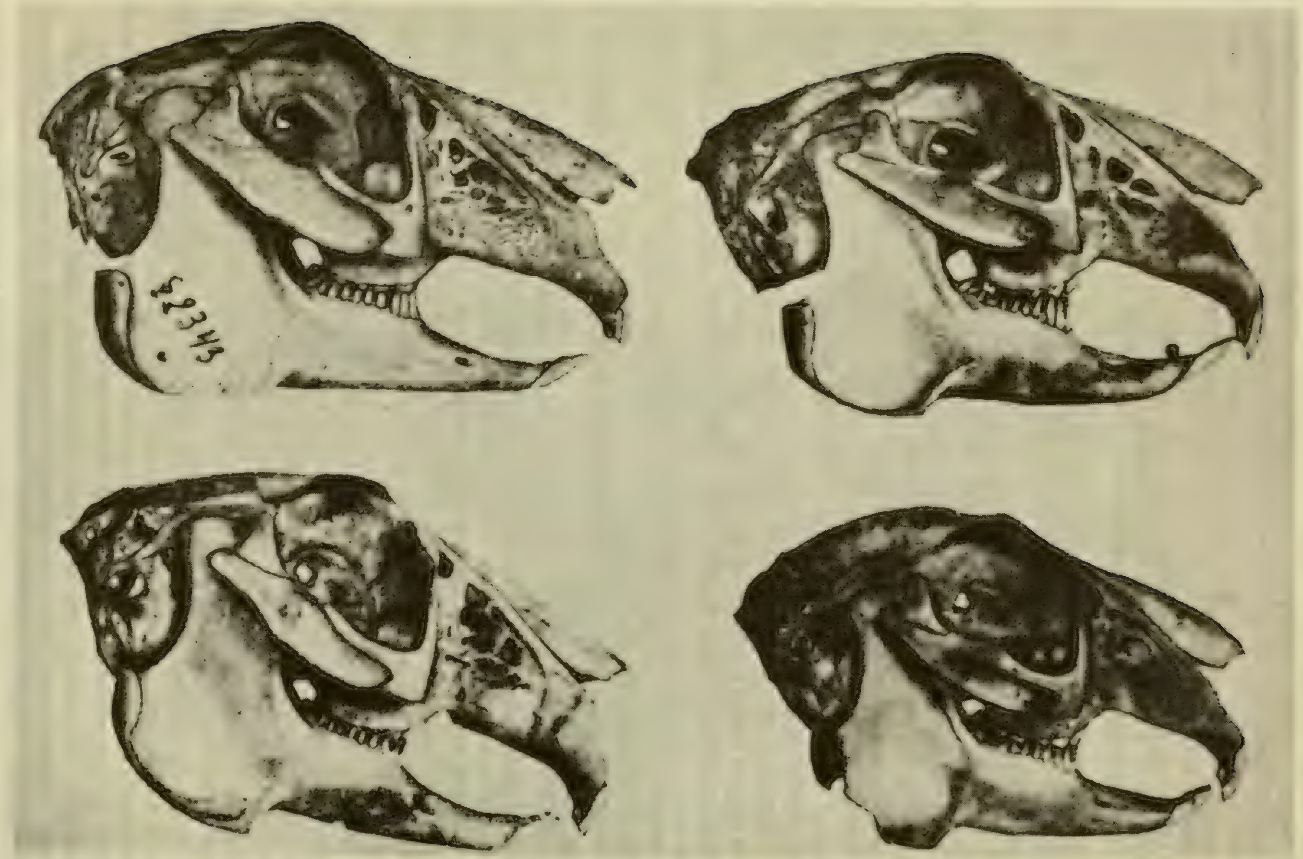
SYSTEMATIC NOTES. The above diagnosis shows that the color of summer fur of L. transbaikalicus differs little from that of the typical form. The general color of the Transbaikal blue hare is lighter. Its ears do not show an admixture of blackish tones. Measurements of the Transbaikal blue hare smaller than those of the typical form.

Examination of a small series of Transbaikal blue hares showed that their color is variable.

No. M. 4506 female, 22 August 1928 from the Chita District (collected by B. A. Kuznetsov) closely resembles specimens from Novgorod in the color of the back. However, the latter have a markedly black anterior inner margin of the ears. The color of the ears of the Transbaikal subspecies is identical with that of the back, grayish brown with a slight straw mottling.

The color of No. M. 4507 male, 22 August 1928 (from the same locality) shows a stronger brownish rust tinge. The color of this hare is practically the same as that of a specimen from the Kanin Peninsula (Semzha river, 18 June 1913, No. S. 2739, collection of the Moscow Zoological Museum). However, the blue hare from Kanin, like all northern blue hares, differs from the Transbaikal subspecies in the dark blackish gray color of the anterior inner margin of the ears.

The color of young L. t. transbaikalicus is typical. They differ clearly from young L. t. kozhevnikovi from the Moscow Region. Their color is much grayer than that of the latter. The general color of the back



FIGURES 126-129. Skulls of subspecies of Lepus timidus. 126—L. t. kozhevnikovi Ogn. (No. 2343); 127—L. t. timidus natio lugubris Kastsch. (No. 3177); 128—L. t. **sibiricorum Johans.** (No. 4858) female, 7 Jan. 1914; 129—L. t. transbaikalicus Ogn. (No. M. 3178).

245 of young Transbaikal hares is rather dull with a straw-brown tinge and slight straw-white mottling (color close to hair-brown and buff-brown).

This mottling is caused by a pale straw-gray subapical band of the hair. Anterior part of head, i.e., nose, lips and eyes more rust-colored. Color of anterior inner margin of ears like that of back. Flanks grayer than back. Transverse stripe on chest gray with a slight brownish tinge.

GEOGRAPHICAL DISTRIBUTION. Throughout Transbaikalia, in the taiga, forest and forest steppe, and steppe. The population of blue hares is subject to yearly fluctuations. Hares from the Great Khingan certainly belong to the Transbaikal subspecies. A blue hare sent by A.S. Lukashkin is in my collection. The specimen was obtained from the upper reaches of the Eimanatchi river along the Bol'shaya Yadora river, in the
247 Haimin Kungssü Forest Concession in the upper reaches of the river Imin Gol. This specimen is very small, especially its skull. The Khingan hares are perhaps even smaller than the Transbaikal hares.

344. Lepus timidus gichiganus J. Allen (1903). Gizhiga, or Okhotsk blue hare

1903. Lepus gichiganus Allen J. Report on the Mammals collect. in North-east. Siberia, Bull. Amer. Mus. Natur. History, XIX,

1929. Lepus timidus gichiganus (Partim!) Ognev S.I., Materialy po sistematike russkikh zaitsev (Material on the Systematics of Russian Hares), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXIII, pp. 491-496.

1926. Lepus timidus gichiganus Ognev S.I., Mlekopitayushchie severo-vostochnoi Sibiri (Mammals of Northeastern Siberia), Vladivostok, p. 74 (partim!).

TYPE LOCALITY AND DEPOSITION. Gizhiga, shore of Sea of Okhotsk, No. 18286 male ad., 11 January 1901, N. G. Buxton. Tye in the collection of the New York Natural History Museum.

MATERIAL EXAMINED: 20 specimens[*].

DIAGNOSIS. In summer fur, color of anterior part of muzzle, cheeks and forehead rust-straw-gray (between clay color and cinnamon, but with a strong dull gray tinge).

Color of upper part of forehead and vertex darkened by black-brown hair.

Color of back dark chestnut-brown-gray with a marked black tinge caused by the black-brown hair tips (with a straw-rust-colored subapical part) and some completely black-brown hair.

Color of anterior inner margin of ears brown-gray with a slight straw tinge, like that of back. There are occasionally specimens in which anterior inner margin of the ears is markedly black.

Color of lower part of back in front of tail deep gray (between dark mouse-gray and deep neutral gray). A broad dull grayish brown stripe across the chest. Winter fur white.

Length of skull 90.2-95 mm (M. 94.7 mm) (93 mm in the holotype[**]): zygomatic width 47-50 mm (M. 49 mm) (49 mm in holotype).

Length of body 550-624 mm (582 mm average for 20 males, 577 mm average for 17 females); hind feet 146-173 mm (M. 164 mm) average for 20 males, and 162 mm average for 17 females); ear (measured along concavity) 78-80 mm.

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[*] J. A. Allen (1903) described the new species (which is actually a subspecies) from 37 pelts and skulls.

[**] According to J. Allen's measurements (1903), the length of the skull is 88-89 mm (94 mm average for males and 91 mm for females).

SYSTEMATIC NOTES. In former publications I stated that L. t. gichiganus is widely distributed between Gizhiga and Penzhina (on the coast of the Sea of Okhotsk) and farther south along the coast of the Tatar Gulf and the Sea of Japan. I thus assumed that it occurs in the Amur Territory, the Ussuri Valley, north of Vladivostok and in forests along the Sikhote-Alin'.

I now have collections from the coast of the Olyutorski Gulf (collected by A.S. Samorodov) and from the river Penzhina in the vicinity of Penzhino (collected by V.S. Bazhanov). A comparison between these small collections and specimens from the Maritime Territory showed that the hares from the Ussuri-Maritime Territory differ from the northern specimens from Okhotsk.

248 The following general rule was found: farther north the color of summer fur of blue hares becomes darker, with gray and blackish brown shades. It should be stressed that blue hares from the mountain region of the Maritime Territory Coast (from Sikhote-Alin') differ from those in the plains of the Maritime Territory. They closely resemble the Kamchatka hares in their darker color and in the black color on their ears. They apparently belong to the race gichiganus,.

The Gizhiga hare is transitional between the very dark, black-eared L. t. kolymensis Ogn. and the much lighter, rust-colored L. t. mordeni Goodw. from the Maritime Territory.

The Kolyma blue hare is also larger than the Gizhiga hare. According to S.A. Buturlin, the weight of the Kolyma hare is 2.7-3.1 kg.

According to V.S. Bazhanov the weight of 44 adult hares caught near the village Penzhino was 1.6-3.0 kg* (2.560 kg average).

According to A.I. Cherskii (in litt.) the weight of hares from Maritime Territory is 2.6-3.4 kg, i.e., more than that of the Gizhiga blue hare.

The Kamchatka blue hares which I saw in the ZMAN collection (e.g., No. 12442 female ad., August 1847, Kamchatka, vicinity of Bol'sheretsk, Vosnesenski) are characterized as follows: 1) intense brown color of back; 2) saturated rust-brown color of top of head; 3) straw tinge on the nose; 4) a pale straw ring around the eye; 5) lower part of back in front of tail gray.

Length of skull 94-98 mm; condylobasal length 86.2-88.9 mm; zygomatic width 48.2-49.9 mm; length of nasals (along oblique line) 37.3-39.8 mm; length of upper row of molars 18.6-19.2 mm.

In my opinion, the Kamchatka blue hares can be considered as belonging to L. t. gichiganus. In the ZMAN collection are some blue hares from the upper reaches of the Iman river on the Sikhote-Alin' (collected by K.K. Flerov). Color of back of these specimens intense chestnut-brown with black mottling caused by black hair tips of guard hair. Top of head with marked rust color (between cinnamon and sayal-brown, Ridgway, pl. XXIX 1912). Color of lower part of back not gray but duller, more blackish, differing from the chestnut-brown color of the back.

These specimens and the Kamchatka blue hare are closely related to gichiganus.

GEOGRAPHICAL DISTRIBUTION. J. Allen (1903) described L. t. gichiganus from a specimen from Gizhiga (on the Sea of Okhotsk Coast). Specimens from near the village Penzhino (along the Penzhina) and also from

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* Only two specimens of this series weighed 3 kg.

249 Apuka (Olyutorski Gulf) are in my collection. During the Chukchi expedition of the All-Union Arctic Institute, L. A. Portenko collected a good series of skulls from near Markov (near the Anadyr river). These skulls are small and generally resemble those of L. t. gichiganus. Series of summer pelts from near Markov should be examined to determine their status. Judging from the limited material available L. t. gichiganus apparently occurs in this region. Transitional forms to a more northern race probably occur here. On 6 July 1932 near the Shchuch'ya river L. A. Portenko obtained a specimen with marked black anterior margin of the ears. Another specimen shot on 7 July 1932 did not show such black margins, and the color of the ears was generally like that of the back. The Gizhiga blue hare occurs in Kamchatka, along the northern coast of the Sea of Okhotsk and in Central Yakutia. The northern boundary of the range of L. t. mordeni and the southern boundary of the range of L. t. gichiganus can only be determined after examination of more material. I have only a few specimens from the middle reaches of the Amur. More material may show that this region is inhabited by L. t. gichiganus.

Blue hares from the Sikhote-Alin' (collected by K.K. Flerov) are closely related to gichiganus in their color (see above). It is possible that in the middle reaches of the Amur there occurs a form which is closely related to the Sakhalin form. On the other hand the Sakhalin blue hare differs very little from L. t. mordeni of the Maritime Territory. More material should be examined in order to establish the relationship between the Sakhalin subspecies L. t. orii Kuroda and the Maritime Territory subspecies L. t. mordeni Goodwin.

345. Lepus timidus mordeni Goodwin (1933). Maritime territory blue hare

1858. Lepus variabilis Schrenck L. v., Reisen und Forschungen im Amur-Lande, I, S. 145-147 (partim!)

1859. Lepus variabilis Maak R., Puteshestvie na Amur (A Journey to the Amur), p. 107.

1870. Lepus variabilis Przheval'skii N. M., Puteshestvie v Ussuriiskom krae (A Journey to the Ussuri Territory), p. 257.

1922. Lepus timidus gichiganus Ognev S. I., Materialy po sistematike russkikh zaitsev (Material on the Systematics of Russian Hares), Ezhegodnik Zoologcheskogo muzeya Akademii Nauk, Vol. XXIII, pp. 491-496.

1927. Lepus timidus gichiganus Gassovski G. N., Gilyui-Ol'doiskii okhotnich'e-khozyaistvennyi raion (The Gilyui-Ol'doi Commercial Hunting District), p. 527.

1927. Lepus timidus Emel'yanov A. A., Promyslovye zveri zemli orochei (Commercial Animals of the Land of the Orochs), in "Productive Resources of the Far East" (Proizvodstvennye sily Dal'nego Vostoka), IV, p. 262.

1933. Lepus timidus mordeni Goodwin G. G., Mammals Collected in the Maritime Province of Siberia by the Morden-Graves North-Asiatic Expedition. Amer. Mus. Novit., 681, pp. 1-18.

TYPE LOCALITY AND DEPOSITION. Monom river near village Troitskii in the Maritime Region. No. 85408 male ad., 16 January 1930, G. Goodwin. Type in the American Museum of Natural History.

MATERIAL EXAMINED: 8 pelts and skulls.

DIAGNOSIS. In summer fur, color of anterior part of muzzle, cheeks and forehead light rust-straw-colored (between cinnamon-buff and pinkish cinnamon, but with a marked grayish tinge).

250 Color of upper part of forehead, vertex and part between ears mixed with brownish-gray caused by blackish hair and blackish tips of many guard hairs.

Color of back generally rust-brown with a straw tinge and gray-brown mottling.

Anterior inner margin of ears with mixed rust-colored and blackish hair; rust tone marked in this region. Color of anterior inner margin of ears almost like that of back, only slightly duller.

Color of lower part of back in front of tail light gray with a brownish tinge (between deep mouse-gray and mouse-gray).

A broad dull straw-gray stripe across the chest.

Winter fur white. Roots of undercoat pale rust-straw colored. Hair of middle part of back about 45 mm long, that of flanks up to 65 mm long.

Length of skull 88-96 mm (M. 93.2 mm); zygomatic width 47-51 mm (M. 48.7 mm).

Length of body 523-570 mm (M. 540.8 mm); hind feet 155-161 mm* (M. 156.8 mm); ears (as measured along concavity) 95-97 mm (M. 95.6 mm).

SYSTEMATIC NOTES. As I had not enough material, I wrote previously that L. timidus gichiganus is widely distributed south of the coast of the Sea of Okhotsk and also that it occurs in the Maritime Region and the Ussuri Territory. After comparing specimens from Ussuri and the southern Maritime Territory with specimens from the Okhotsk Coast I came to the conclusion that L. t. gichiganus differs from L. t. mordeni, which is distributed throughout the Maritime Territory.

G. Goodwin (1933) who described L. t. mordeni from one winter specimen could not give a precise description. He compared the skull and teeth of L. t. mordeni with those of L. t. gichiganus, and found that the skull of the Primorye hare is smaller, but that its teeth are larger. According to Goodwin, the width of the lower incisors of L. t. mordeni is 3 mm and of L. t. gichiganus 2.5 mm. We obtained the following measurements in our material: width of lower incisor of L. t. mordeni 3; 3; 3; 3.1; 3.2; 3.2; 3.4 mm (M. 3.14 mm); of L. t. gichiganus 2.8; 2.9; 3.3 mm (M. 2.75 mm). These differences are very small and not significant. According to Goodwin the transverse width of the crown of the first upper premolar of L. t. mordeni is 5 mm against 4-4.5 mm in L. t. gichiganus. I obtained the following measurements from our material: in L. t. mordeni 4.3; 4.5; 4.8; 5; 5; 5.1 mm (M. 4.63 mm); in L. t. gichiganus 4; 4.2; 4.2; 4.5 (M. 4.2 mm). According to Goodwin, the width of the largest upper molar of L. t. mordeni is 6.8 mm and 5-6 mm (M. 5.7 mm) in L. t. gichiganus. I obtained the following measurements from our material: in L. t. mordeni 5.7; 6; 6; 6; 6; 6.3; 6.5 mm (M. 6 mm); in L. t. gichiganus 6; 6.1; 6.2; 6.2 mm (M. 6.1 mm).

These data show that the differences of the teeth of the Gizhiga and
251 Maritime Territory blue hares are very small. The conclusions of Goodwin, reached after comparison of a single skull of L. t. mordeni with a skull of L. t. gichiganus are, to say the least, premature.

The following real differences exist between specimens from Gizhiga and those from the Maritime Territory: 1) color of summer fur of Gizhiga subspecies darker and grayer; 2) measurements and weight of Gizhiga blue hare smaller. Examination of more material may prove that the measurements of the skull of the Gizhiga blue hare are also smaller. The differences between L. t. gichiganicus and L. t. mordeni are thus very small. They cannot, however be placed into one subspecies at present. More material is necessary in order to make the differentiation more specific.

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* According to G. Goodwin, the hind feet are 180 mm long in the holotype of L. t. mordeni.

GEOGRAPHICAL DISTRIBUTION. This subspecies is widely distributed in the Maritime Territory, the valley of the Ussuri, Khungari and perhaps along the middle and lower reaches of the Amur. In my collection is a specimen from Nikolaevsk-on-Amur which is closely related to L. t. mordeni.

It is difficult to say how far north this subspecies is distributed. Its range seems to pass into that of L. t. gichiganus. As stated above, a darker form which hardly differs from L. t. gichiganus occurs in the Sikhote-Alin Range.

The southern boundary of the range of L. t. mordeni is not known. A. de Sowerby (1923) did not record this subspecies from Manchuria. The late A. I. Cherskii (in a letter of 17 Feb. 1914) wrote as follows on the distribution of the blue hare in the Ussuri and Maritime Territories: "The blue hare is sold in the Vladivostok market as 'imported game'. According to Maksimovich (apud Radde), the southern boundary of its range passes north of Lake Hanka. I found hares of this subspecies in 1911, in the upper reaches of river Odarka, in the Lake Hanka System, and 27 km east of the Yevseyevka Station of the Ussuri Railway. This moves the southern boundary south by a whole degree. In the mountain forest of the upper reaches of the Odarka river blue hares are more common than the Manchurian hare."

346. Lepus timidus orii Kuroda (1928). Sakhalin blue hare

1889. Lepus timidus Nikol'skii, A. M., Ostrov Sakhalin i ego fauna pozvonochnykh zhivotnykh (The Vertebrate Fauna of Sakhalin Island), pp. 126-127.

1890. Lepus variabilis Suprunenko, Pozvonochnye Sakhalina (Vertebrates of Sakhalin), p. 39.

1923. Lepus timidus Sowerby A., The Naturalist in Manchuria, II-III, pp. 173-174 (Sakhalin Island).

1928. Lepus timidus orii Kuroda N., The Mammal Fauna of Sakhalin, — Journal of Mammalogy, Vol. 9, No. 3, pp. 223-224.

1931. Lepus timidus saghaliensis Abe I., A Synopsis of the Leporine Mammals of Japan, Journ. of Science of Hiroshima University, ser. B, div. I, pp. 49-50.

TYPE LOCALITY AND DEPOSITION. Sakhalin Island, Naihoro (western coast of central part of Japanese Sakhalin), No. 1234, male ad., 6 May 1926, Nagamichi Kuroda's collection.

MATERIAL EXAMINED: 4 specimens.

252 DIAGNOSIS. Owing to lack of material I cannot give a diagnosis of this subspecies, the existence of which as a systematic unit should be verified.

In summer fur, color of upper part of forehead, vertex and region between ears dark brownish gray.

Color of back brownish gray with a straw tinge caused by yellowish straw colored subapical bands of hair. Tips of hair blackish brown.

Color of anterior inner margin of ears gray-brown with a straw tinge, little darker than back.

Color of lower part of back in front of tail brownish gray, almost without straw tone, and thus duller and darker than middle of back.

A dull straw gray stripe across the chest.

Winter fur and under fur white.

SYSTEMATIC NOTES. The Sakhalin subspecies was described by N. Koruda (1928) as L. t. orii. According to N. Koruda it differs from

L. t. gichiganus as follows: 1) skull large, tail and hind feet shorter; 2) ears of L. t. orii longer than those of L. t. gichiganus; 3) in summer fur, color of forehead and sides of head pale rust-brown and reddish, (gray-brown in L. t. gichiganus*); color of back, flanks and haunches grayish brown or reddish brown (dark gray in gichiganus). Lower part of back of L. t. orii usually grayer and darker than middle of back.

In 1931 I. Abe again described the L. t. orii from a specimen from Otomari [Korsakov] (Japanese Sakhalin), as L. t. saghaliensis. He did not mention N. Kuroda's description and only referred to Kishida's book "An Explanatory Illustration of Japanese Mammals", 1924, in Japanese. In this work the Sakhalin hare is called Lepus gichiganus subsp. ?

According to I. Abe the Sakhalin hare is characterized as follows: 1) elevated postorbital processes; 2) ears longer than in L. t. gichiganus; 3) hind feet longer, 180 mm long. This last character differs from the measurement given by N. Kuroda.

On Hokkaido (Yezo) L. timidus ainu Barrett-Hamilton occurs, which I. Abe considers, without any justification, as a separate species. He gives the following characters as typical for Lepus ainu: 1) low posterior part of the postorbital processes (as in L. hibernicus);
253 2) large skull: length of skull of the hare from Hokkaido 98-101 mm.

All these data indicate that a subspecies which is closely related to L. t. orii and possibly identical with it occurs on Yezo. The relationship between the Sakhalin hare and hares from Hokkaido will have to be determined after examination of more material.

In conclusion I give measurements of the Sakhalin blue hare and the Hokkaido blue hare (according to N. Kuroda and I. Abe).

Skull measurements of Lepus timidus orii Kuroda (in mm)

Number	Length	Basal length	Zygomatic width	Mastoid width	Width of skull behind orbit	Length of nasals	Width of nasals at the base	Length of upper tooth row	Length of mandible without incisors	Height of mandible
660	100	80.5	51	37.1	—	46	21	17	80	53.1
1229	94.5	76	51.5	36	16.5	40.1	21.5	17.9	74.5	48.5
1230	94.5	76	49.9	32	15	39	20.5	18	76.5	49.5
1233	97.2	77.5	52	34.1	16	41.5	20.5	17.5	75	50
1234 Type	99.5	79	50	31.1	13.5	42.1	20.1	19	77.5	51.5

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* N. Kuroda gives an inexact description of the color of the forehead and sides of the head of L. t. gichiganus. In specimens examined, these parts were rust-straw-gray with variable degrees of rust tone. The color of the back of gichiganus is not dark gray, but a dark chestnut-brown-gray color.

Measurements of L. t. saghaliensis Abe (male No. 28)

Length	Basal length of skull	Zygomatic width	Width of supraorbital space	Width of nasals	Length of nasals	Length of frontal suture	Width of olfactory foramina	Length of bony palate	Width of incisive foramina	Length of incisive foramina	Diastema	Length of upper tooth row	Length of ear (from occiput)	Length of ear (along concavity)	Length of foot	Length of tibia
98.5	79	49.5	17	19	40	43	16	9	10.5	23.5	25	16.5	115	95	180	149

The measurements of specimen in the ZMAN collection are as follows (in mm):

Length of skull	94.3
Zygomatic width	46.8
Width of skull behind orbit	15.2
Width of nasals at the base	21.2
Length of upper tooth row	19.2
Length of mandible	65.8
Height of mandible	44.1

The data on the Sakhalin blue hare show that there is insufficient material to clarify the status of this form.

254 The descriptions by Kuroda and Abe are not complete, being based on too little material and giving accidental characters which are hardly typical. The Sakhalin blue hare is certainly closely related to the Primorye hare (mordeni). It is however impossible to consider them as identical. L. t. mordeni is closely related to L. t. gichiganus in various characters. L. t. mordeni is probably only a lighter natio of gichiganus, and the Sakhalin subspecies is probably synonymous with the Primorye subspecies. The Okhotsk-Maritime Territory and Sakhalin are thus probably inhabited by one species with a lighter, southern natio.

GEOGRAPHICAL DISTRIBUTION. The subspecies occurs only on Sakhalin Island. It possibly also occurs on the continent, along the middle reaches and northern part of the Amur (near the coast). The small collections examined from the lower reaches of the Amur were closely related to L. t. mordeni

347. Lepus timidus kolymensis Ogn. (1922). Kolyma blue hare

1884. Lepus variabilis Bunge A., Naturhist. Beobachtung. im Lena-Delta. Mém. Biolog. de l'Academ. Imp. St-Petersb., XII, S. 33 (Lena estuary).

1887. Lepus variabilis Bunge A., Berichte über die Expedition nach Neusibirischen Ins. S. 39-40 (river Yana, Yana estuary).

1914. Lepus tschuktschorum Allen G. I. Proceedings New Engl. Zoological Club, V, p. 66 (Bol'shoi Baranovyi).

1922. Lepus timidus kolymensis Ognev S. I., Nekotorye dannye po sistematike russkikh zaitsev (Data on the Systematics of Russian Hares), Biologicheskie Izvestiya, Vol. I, p. 106.

1926. Lepus timidus kolymensis Ognev S. I., Mlekopitayushchie severo-vostochnoi Sibiri (Mammals of Northeastern Siberia), pp. 72-77.

TYPE LOCALITY AND DEPOSITION. Pokhodskoe Village, 80 km below Nizhne-Kolymsk along the Kolyma river. Type No. 8028 female 4 June 1905, S. A. Buturlin, ZMAN collection.

MATERIAL EXAMINED: 15 pelts and skulls.

DIAGNOSIS. In summer fur, color of anterior part of muzzle, cheeks and forehead dull brownish gray with a slight rust tinge.

Color of upper part of forehead, vertex and region between ears darker as a result of presence of black hair and black-brown tips of numerous hairs which have straw-gray subapical bands.

Color of back dark, dull brownish gray with a slight straw-gray tinge.

Anterior inner margin of ears almost completely black. Hairs in this area have dark gray roots, straw-gray subapical bands and broad black tips. They are so strongly developed that they give an almost black color; this is typical for this subspecies.

Color of lower part of back in front of tail dark gray. A dull gray stripe across the chest.

Winter fur and undercoat completely white.

Length of skull 93.2-99.2 mm (M. 96.6 mm); zygomatic width 47.7-51 mm
255 (M. 49.3 mm).

SYSTEMATIC NOTES. As stated above, the Kolyma hare is larger than the Gizhiga hare, as shown by its weight and the size of its skull.

The Kolyma hare is characterized as follows: 1) color of back black and without any rust tone; 2) blackish tone especially marked in middle of back, on ears and occiput; 3) head and cheeks dull brownish gray.

The Kolyma blue hare is closely related to the Gizhiga hare. It is a darker race confirming the rule that farther north the summer fur becomes darker and blacker.

GEOGRAPHICAL DISTRIBUTION. The Kolyma blue hare occurs along the Kolyma river and apparently also in the Indigirka Valley. In the east, beyond the Stanovoi Range to the Anadyr river in the north, L. t. gichiganus occurs. Another subspecies possibly occurs in the valley of the Yana river. According to S. A. Buturlin (1913), the hares in this region are very small and weigh only 1.4-1.6 kg. This could be decided if we could obtain material from the region between the Tas-Khayakh-Takh and Verkhoyansk ranges.

348. Lepus timidus begitschevi Koljuschev (1936). Taimyr blue hare

1933. Lepus spec.? Kolyushev I. I., Materialy po faune i promyslu zapadnogo ugla Taimyrskogo poluostrova (Material on the Fauna and Animal Trade of the Western Corner of the Taimyr Peninsula), Materialy po izucheniyu Sibiri, Vol. IV, pp. 15-16.

1936. Lepus timidus begitschevi Kolyushev I. I., Mlekopitayushchie krainego severa, zapadnoi i srednei Sibiri (Mammals of Extreme Northern, Western and Central Siberia), Trudy Biologicheskogo nauchno-issledovatel'skogo instituta, Vol. II, Tomsk, pp. 304-306.

TYPE LOCALITY AND DEPOSITION. Western coast of the Pyasina Gulf. Type obtained on 7 March 1930, in I. I. Kolyushev's private collection.

MATERIAL EXAMINED: 22 pelts (most of them with skulls).

DIAGNOSIS. Muzzle grayish brown with a marked admixture of rust colored hair, especially marked on cheeks.

Back pale gray. Neck and sacral region with a marked ash-blue tinge. Scattered black hairs on the back, especially in the lower parts.

Ears pale gray with a weak rust tinge and a few white hairs.

Length of skull 98-108 mm (M. 103.4 mm); condylobasal length 88-95.2 mm (M. 92.6 mm); zygomatic width 50.6-54 mm (M. 52.7 mm); length of upper row of molars 18.6-20.5 mm (M. 19.5 mm). (See Figures 130, 131.)

Length of body with head 575-740 mm; hind feet 143-171 mm; ear 80-94 mm.

SYSTEMATIC NOTES. An excellent series of Taimyr blue hares collected by E. O. Yakovlev is in the ZMAN collection. Some of these hares originate from the eastern Taimyr and some from the Khatanga Gulf. They correspond in color and measurements to I. I. Kolyushev's description.

In the Moscow Zoological Museum is a series of 8 pelts (unfortunately 256 without skulls) which were obtained by A. F. Chirkova in the lower reaches of the Khatanga in the tundra near the village Khatanginskoe.

These hares differ from east Taimyr blue hares in their color and smaller size.

Description. In summer fur, color of middle part of anterior half of muzzle and cheeks very pale gray-straw-yellow (close to pinkish buff with a cinnamon-buff tinge). This color is much duller because of gray and blackish hair. Sides of muzzle and lower part of cheeks dull gray-straw-white. Color of forehead duller straw-gray with a slight rust tinge. Eye surrounded by a completely white ring.

Color of back dull gray (mouse-gray) with light straw mottling. This mottling creates a straw-gray color on the back, very similar to drab.

Flanks, lower part of back in front of tail and stripe across chest gray (light mouse-gray) with a slight blackish tinge caused by black hair tips or gray-black subapical bands.

Color of anterior inner margin of ears straw-gray-brown, similar to color of back.*

Length of body 470-550 mm; hind feet 132-157 mm (M. 141.6 mm); ear (measured along concavity) 82-93 mm (M. 87.7 mm).

The skulls of the series have been lost. We therefore cannot say whether these specimens are identical with those collected by E. O. Yakovlev. It seems that blue hares from the lower reaches of the Khatanga are different from the Taimyr specimens.

The Khatanga blue hares are characterized as follows: 1) dull straw-gray-yellow color of head; 2) gray color of back with slight straw mottling; 3) light anterior inner margin of ears. This form differs from L. t. timidus in the lighter gray fur without the brownish tones which are well marked on the back of north European specimens.

Compared with the Kolyma subspecies, the Khatanga blue hare is grayer and lighter, without black color on the ears and the upper part of the back.

It differs from the Taimyr-Pyasina form in its small size, in some color characters such as the absence of bluish gray tones on the back, and in the color of the head.

If the very large hares from the Gyda Peninsula (described by S. P. Naumov, 1931) are identical with the Pyasina and Taimyr blue hares, L. t. begitschevi should also include hares from near the village Dudinka (lower reaches of the Yenisei) a specimen of which is in the ZMAN collection. Specimens from the Taz and Kureika rivers are not identical with L. t. begitschevi.

257 In my collection are specimens from the Taz river collected by R. E. Kol's. The skull of these specimens is not large, and closely resembles that of specimens from the Kolyma river. F. F. Shillinger caught a

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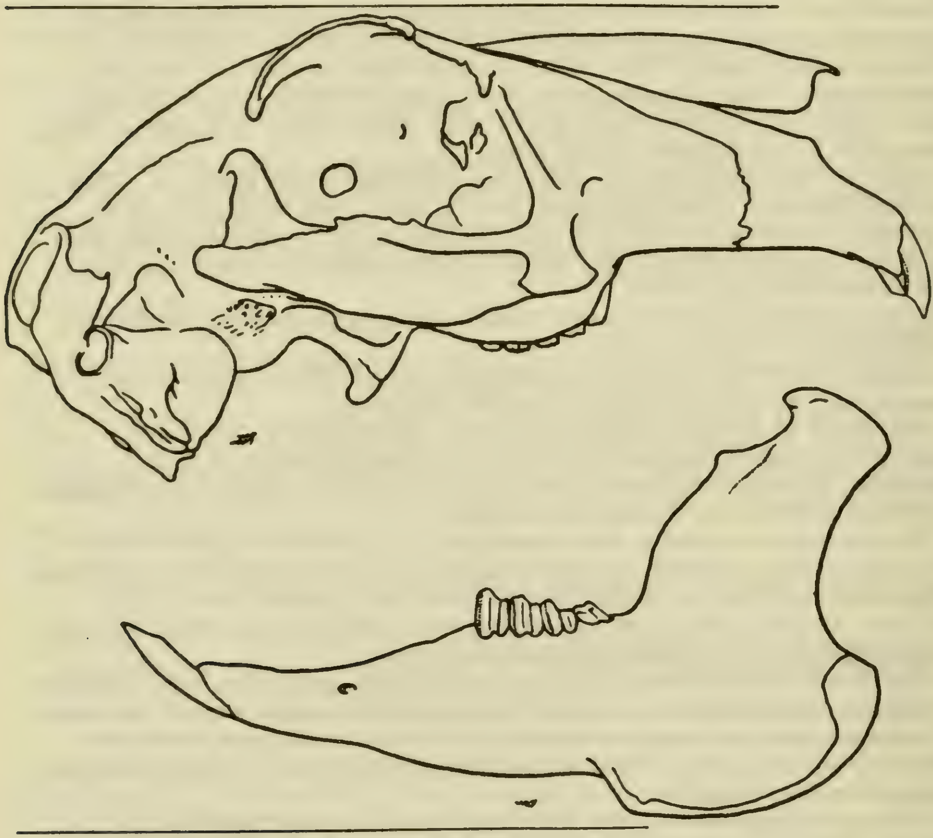
* All specimens of the series examined were either in summer or in transitional fur (at the beginning of the autumn molt). I did not see any winter specimens of this form.

specimen near the Kureika river (25 Jul. 1925). Although it was caught in late summer, it had much white fur on its head, ears and back. Black spots of summer fur could be seen among the white fur. The inner side of the ears was completely black.

The full summer fur of this form would certainly be very dark. A specimen caught by R. E. Kol's on 30 May 1927 near the Taz river had retained almost completely its white winter fur. The dark summer fur showed on the ears and on some parts of the back. The ears were also black, but lighter than those in the specimen from the Kureika river.



FIGURES 130-131. Taimyr blue hare, *Lepus timidus begitschevi* Koljuschev. Specimen No. 18786, 4 June 1933, Taimyr District, Kardo Cape, Khatanga Gulf, E. O. Yakovlev, ZMAN collection

Drawing by Yu. A. Kostylev

New material will have to be examined in order to decide which 258 subspecies occurs along the Taz, Yenisei and Kureika rivers, and south of the Lower Tunguska.

GEOGRAPHICAL DISTRIBUTION. This form occurs on the Geidal Peninsula, throughout Taimyr, in the lower reaches of the Yenisei near the village Dudinka and in the east along the Khatanga Gulf coast.

A different form possibly lives along the lower reaches of the Khatanga.

349. Lepus timidus tschuktschorum Nordquist (1883). Chukchi blue hare

1883. Lepus timidus L. var. tschuktschorum Nordquist O., Antecknigar och studier till Sibirska sshafskustens Däggdjursfauna Vega Expeditionens Vetenskapliga Iakttagelser, Vol. II, pp. 84-90, figs. 8, 9-10; p. 88.

1903. Lepus tschuktschorum Allen I., Report on the Mammals Collect. in Northeast Siberia. Bull. Americ. Mus. Nat. History, XIX, p. 159-160 (near Cape Chaplin — Indian Point).

1926. Lepus tschuktschorum Ognev S. I., Mlekopitayushchie severov-vostochnoi Sibiri (Mammals of Northeastern Siberia), p. 77.

1927. Lepus tschuktschorum (partim!) Sokol'nikov N. P., Okhotnich'i i promyslovye zveri Anadyrskogo kraya (Game and Commercial Animals of the Anadyr Territory), Byulleten' Moskovskogo obschestva ispytatelei prirody, XXXVI, p. 133.

TYPE LOCALITY AND DEPOSITION. Chukot Peninsula. Type in the Stockholm Museum.

MATERIAL EXAMINED: 10 specimens.

DIAGNOSIS. In summer fur, color of anterior part of muzzle, cheeks and forehead dull brownish gray with a slight straw-rust tinge (buff-brown with a slight rust tinge).

Color of upper part of forehead, vertex and region between ears much darker because of the large admixture of completely black hair, and black bands on hair with straw-yellow subapical bands.

Color of back dull straw-gray-brown with a black tinge which forms a dull mottling with straw shades.

Color of flanks and lower part of back grayer (more ash colored) than middle part of back.

Anterior inner margin of ears with marked black tone; straw mottling little marked.

A dull gray stripe across the chest.

Winter fur and undercoat white. Hair unusually luxuriant, delicate, silky and long. Hair of back 62 mm long, hair of flanks and underparts 80 mm.

Skull massive, with broad nose and zygomatic arches. Length of skull 98-106 mm (116 mm according to Nordquist) (M. 103 mm); zygomatic width 51-54.5 mm (57 mm according to Nordquist) (M. 52.8 mm). See Figure 125.

Length of body 610-680 mm; hind feet 150-165 mm.

SYSTEMATIC NOTES. The range of this subspecies is adjacent to that of the Kolyma subspecies. It differs from the latter in its larger size, and its larger and more massive skull. Summer color of eastern Chukchi hare lighter and grayer than that of the Kolyma blue hare. Winter fur of tschuktschorum more luxuriant and longer. This subspecies differs clearly from the Taimyr blue hare (L. t. begitschevi) in its color.

259 GEOGRAPHICAL DISTRIBUTION. It occurs only in the northeastern periphery of the Chukchi Peninsula. A form which is apparently identical with L. t. gichiganus occurs along the river Anadyr near Markov. D. G. Elliot ("Synopsis of the Mammals of North America", Publ. of the Field Nat. Hist. Museum, Zoolog. Ser., Vol. II, Chicago, p. 271) writes that Lepus tschuktschorum occurs in northern Alaska from the estuary of the Kuskokvim river up to the Arctic Ocean. The occurrence of the Chukchi blue hare in Alaska has not been confirmed in later publications of American zoologists. In Alaska occur Lepus othus

Merriam and L. poadromus Merriam. The relation of these species to L. timidus, especially to the Chukchi subspecies, will have to be determined by comparison of material.

Genus **Allolagus** Ognev

1922. Lepus Ognev S. I., Materialy po sistematike russkikh zaitsev (Materials on the Systematics of Russian Hares), Ezhegodnik Zoologicheskogo Muzeya Akademii Nauk, Vol. XXIII, p. 485.

1929. Allolagus Ognev S. J., Zur Systematik der russischen Hasen, Zoologischer Anzeiger, Bd. 84, H. 1/4, S. 72.

1936. Lepus (Caprolagus) Zolotarev N. T., Mlekopitayushchie basseina reki Imana (Mammals of the River Iman Basin), p. 69.

Ears (measured from occiput) about as long as, or slightly longer than, head.

Dorsal side of tail black-brown, clearly different from general gray color of the other part of tail.

Hind legs short. When the animal stands, the hind legs seem little longer than the forelegs.

Mesopterygoid fossa about as wide as the length of the bony palate.

Adults without interparietal.

Postorbital processes elongate triangular. The anterior angles relatively short.

Width of interorbital space posterior to the postorbital process (in its narrowest place) 60.4 % of the width of both nasals in their posterior third.

Length of nasals along the line connecting the outer posterior corner with the inner anterior corner about as long as, or slightly shorter than, the frontal suture.

Width of posterior nasal foramen about as long as the bony palate.

Width of incisive foramina (in their widest part) about as great as the length of the bony palate.

Incisive foramina about as long as the upper diastema.

Type species: Lepus mandshuricus Radde.

261 GEOGRAPHICAL DISTRIBUTION. Southern Ussuri Territory, Manchuria, and the Hondo [Honshu] and Kyushu Islands.

161. Allolagus mandshuricus Radde (1861). Manchurian hare

1861. Lepus mandshuricus Radde G., Neue Säugethier-Arten aus Ost-Sibir., Mél. Biol. Bullet. de l'Academ. Imp. de St-Petersb., III, S. 684-686.

1861. Lepus mandshuricus Maximowicz H., Zoologisch. Nachricht, Mél. Biol., III, S. 693.

1862. Lepus mandshuricus Radde G., Reisen im Süden von Ost-Sibir., S. 215-223.

1870. Lepus mandjuricus Przheval'ski N. M., Puteshestvie v Ussuriiskom krae (A Journey to the Ussuri Territory), Sankt Petersburg, pp. 257-258.

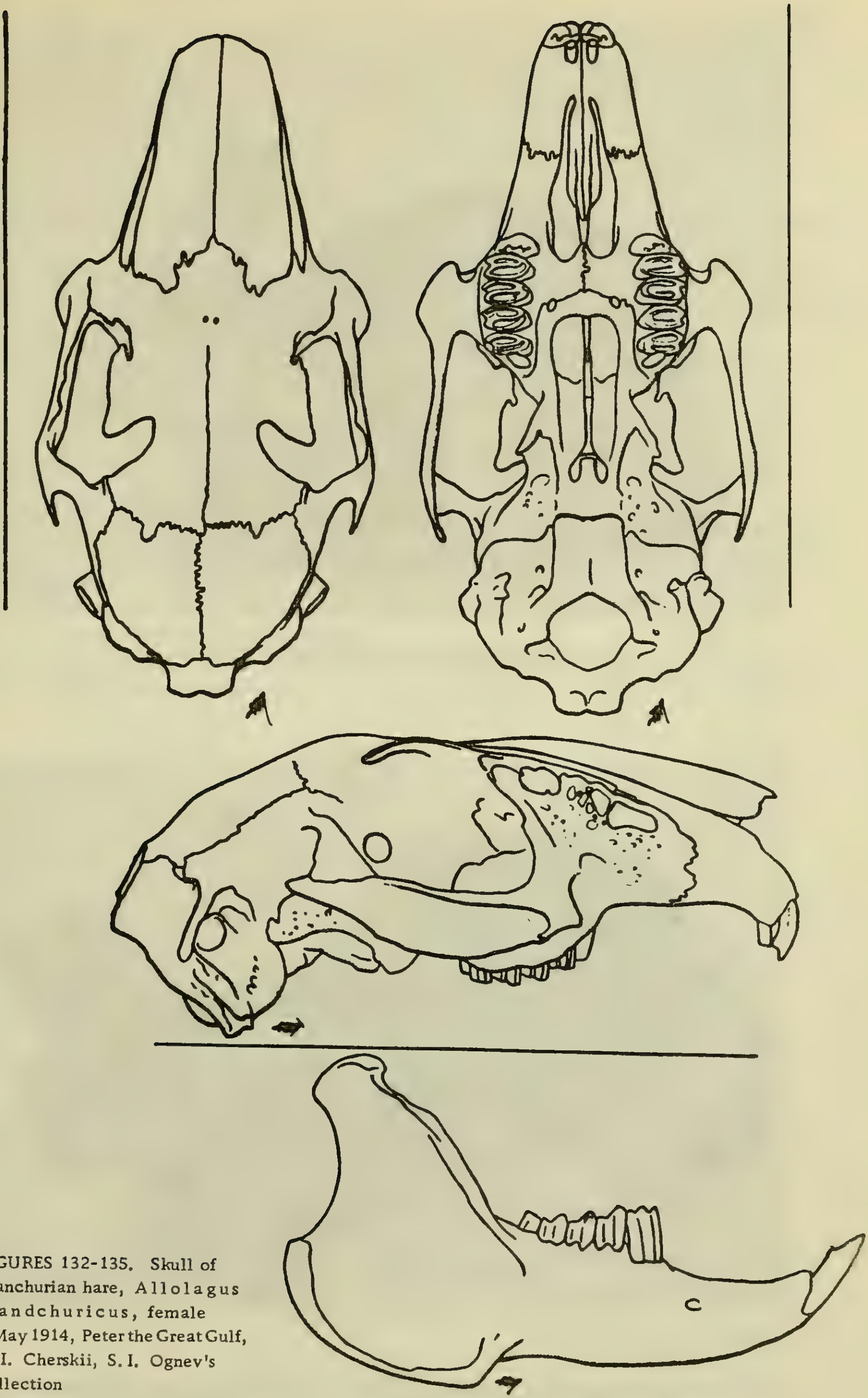
1922. Lepus mandshuricus Ognev S. I., Materialy po sistematike russkikh zaitsev (Material on the Systematics of Russian Hares), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXIII, pp. 485-491.

1922. Lepus mandshuricus subphasa melanonotus Ognev S. I., op. cit. p. 489.

1923. Lepus mandshuricus Sowerby A. de C., The Naturalist in Manchuria, II-III, pp. 171-172.

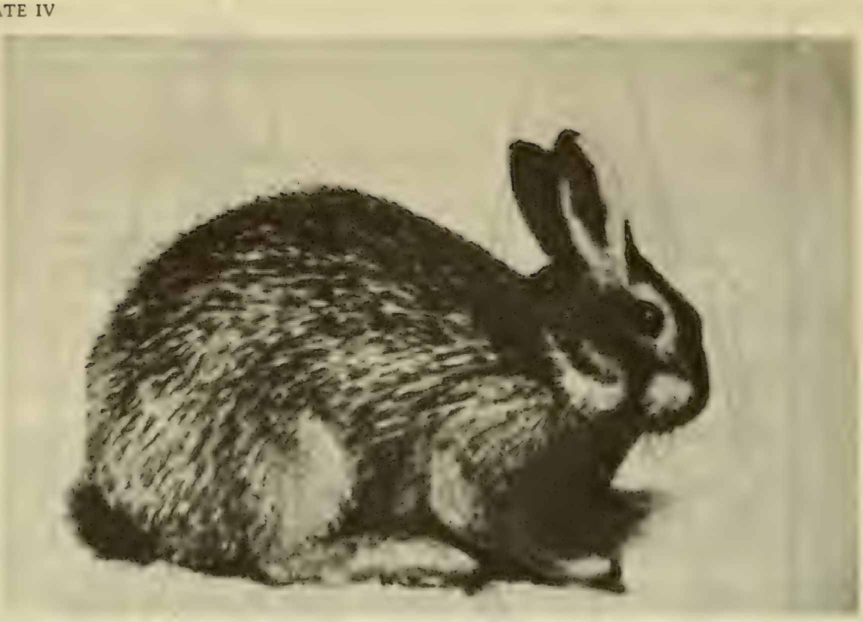
1929. Allolagus (mandshuricus) Ognev S. J., Zur Systematik der russischen Hasen, Zoologisch. Anzeiger, Bd. 84, H. 1/4, S. 72.

1936. Lepus (Caprolagus) mandshuricus Zolotarev L. T., Mlekopitayushchie basseina reki Imana (Mammals of the River Iman Basin), pp. 69-70.

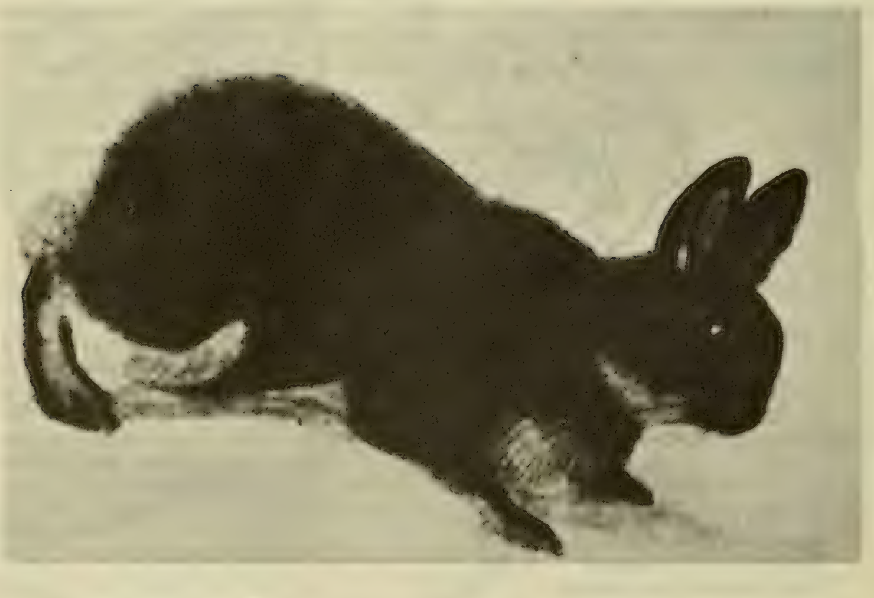


FIGURES 132-135. Skull of Manchurian hare, Allolagus mandchuricus, female 2 May 1914, Peter the Great Gulf, A. I. Cherskii, S. I. Ognev's collection

Drawing by Yu. A. Kostylev



Allolagus mandshuricus Radde. Winter fur



Allolagus mandshuricus Radde. A melanic specimen in winter fur

Drawing by V. A. Vatagin

261 NAMES: Manchurian Hare (English); Mandchurischer Hase (German).

LOCAL NAMES: Tolo, taula, tolau (Birar Evenki-Tungus); borto-gormako (Nanai-Gold); borta-gurmakhung (Manchuria).

TYPE LOCALITY AND DEPOSITION. Bureya Mountains. Type in ZMAN collection.

PRINCIPAL FIGURES. Radde G., Reisen im Süden von Ost-Sibirien, 1862, S. 215-223, Taf. VIII, Fig. 1 a-d (entire animal in color, skull).

MATERIAL EXAMINED: 19 pelts and skulls.

DIAGNOSIS. Head relatively large.

Outstretched ear (measured from occiput), as long as or slightly longer than head.

Tail (including terminal hair) 60-70% as long as hind foot (without claws).

In summer and winter fur, dorsal side of tail black-brown, merging with the general gray background of the other part of the tail.

Hair does not become white in winter, but grayer than the summer fur. Winter fur of melanic specimens black-brown.

Fur soft. Guard hair soft, straight and thicker than in the desert hare. Guard hair not curly. Undercoat wavy and curly.

I could not determine the number of teats from the material at my disposal.

Length of nasals, measured along the line connecting the inner anterior 262 corner with the outer posterior corner, about as long as, or shorter than, the frontal suture.

Length of postorbital processes about 51.5% of maximal width of both nasals measured in their widest part.

Posterior third of incisive foramina widened. Their lateral margins straight, without protuberances.

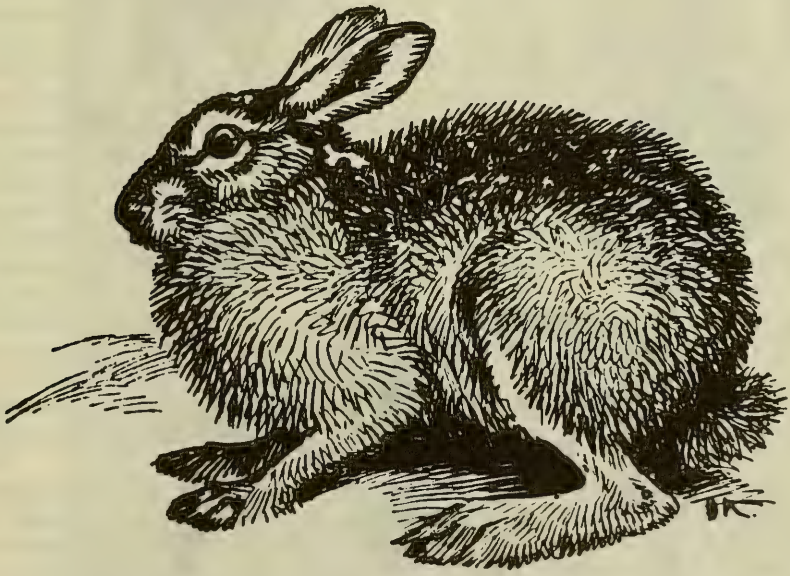


FIGURE 136. Manchurian hare, Allolagus mandchuricus Radde.
Drawing by A. N. Komarov

Bony palate measured lateral to anterior process about as long as the incisive foramina measured in their posterior third are wide.

Bony palate about as long as the mesopterygoid fossa in its widest part.

Lower diastema about 86% of the length of the lower tooth row, that is, shorter than the tooth row. This was not found in any of the other hares.

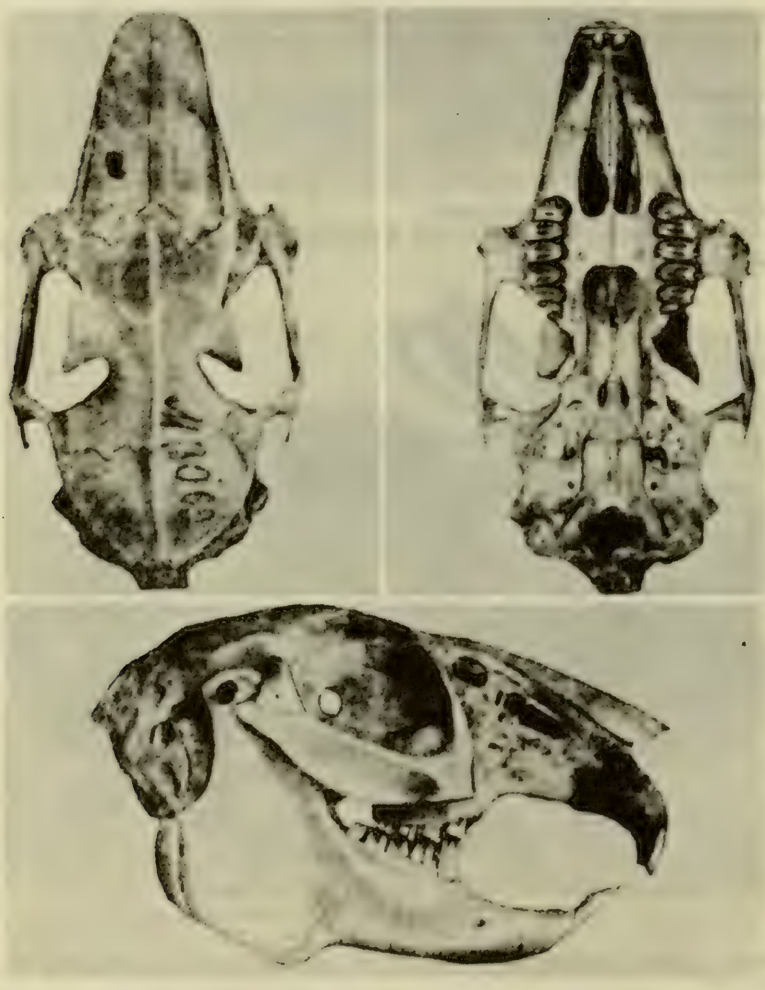
Anterior lower premolar slightly inclined backwards in profile.

Mandibular condyle massive, slightly inclined backwards.

Posterior-ventral plate of mandible from corner of angular process to notch at beginning of horizontal mandibular process very large. Distance between angular process to notch of horizontal mandibular process 1 1/2 times as large as distance between anterior alveolus of premolar to tip of lower incisor.

263 Bullae osseae very small, little inflated and slightly protruding forward (Figures 132-139).

Length of skull 82.1-89 mm (M. 85.4 mm); zygomatic width 40-44 mm (M. 41.9 mm); length of nasals 32.8-37.9 mm (M. 35.5 mm); width of nasals 14-18 mm (M. 15.7 mm).



FIGURES 137-139. Skull of **Allolagus mandchuricus** Radde, No. M. 3069, Maritime Territory, S. I. Ognev's collection

Length of body and head 420-540 mm (M. 473.5 mm); hind feet (without claws) 117-130 mm (M. 123.4 mm); ear (measured from occiput) 84-95 mm (M. 88.9 mm); tail with terminal hair 100-160 mm (M. 115.2 mm).

Weight 1650-2600 gms.

ADDITIONAL DESCRIPTION. The diagnosis of the genus and the description of the species show that the skull of the Manchurian hare has 264 some specific features of which the following are the most characteristic: 1) width of bony palate; 2) narrow incisive foramina; 3) small size of bullae osseae; 4) short diastema compared with the massive and long rows of molars; 5) massive mandibula, especially its posterior-ventral plate; 6) relatively small orbits.

COLOR. WINTER FUR. Color of back with a mixture of light rust-brown and a marked black tone (plate IV, upper figure).

Color of occiput like that of back. Forehead and anterior part of nose darker because of the greater admixture of black hair tips. Area around eyes rust-white. Cheeks below the eyes with a diffuse blackish pattern. Sides of cheeks whitish. Muzzle dull brown-rust-gray. Two irregular white spots below the nostrils.

Neck rust-chestnut-brown, more rust colored than fawn (Ridgway, plate XL). Throat white with a light straw-bay tinge. Chest pale straw colored with vinaceous tinge (closely related to avellaneous and vinaceous-buff, Ridgway, plate XL). This color also covers the forelegs, flanks, lateral parts of groin and part of the hind feet. Belly and groin white.

Ears short. Anterior inner margin of ears variegated with a admixture of blackish and rust-brown hair. Inner sides of ears with a rich rust-ocher-brown tone. Tip of ears (about 35 mm on inner and outer sides) black or black-brown.

Tail with luxuriant whitish gray hair. Dorsal side of tail blackish brown.

This type of color of winter fur is the most common. There also occur grayer specimens with an ash tinge. The general color of the back has a variegated mixture of a whitish ash-gray tone with a blackish tinge. Gray-white tone predominates on the lower part of back.

Anterior part of forehead with a well marked rust tinge. Area around eyes white. Cheeks gray-white. Region behind the eyes pale whitish rust. Occiput with a dull rust-brown tinge.

Throat white. Chest with some pale rust hair and black hair giving a grayish shade. Belly and groin white.

Color of anterior inner margin of ears rust-straw-gray. Inner parts of ears whitish. Tips of ears rust-straw colored, margins black. Ears near the base rust-gray.

Forelegs rust-straw colored. This color is weakly marked on flanks as two spots partly entering the inguinal region. Hind legs dirty straw-gray.

SUMMER FUR. This description is based on a young specimen. Summer hair shorter and coarser. Its general color is intense rust-brown with a straw-black tinge. Color of forehead and occiput almost like that of back. Eyes surrounded with rust-gray hair. Cheeks with much black hair.

265 Neck dull rust-brown, grayer than sayal-brown (Ridgway, 1912, plate XXIX). Belly whitish.

Anterior inner margin of ears with short brownish gray hair. Outer fringe of ears rust-ocher. Outside of ears pale rust-brown. Tail gray with blackish brown dorsal side.

Melanic specimens also occur. These are rare in the Ussuri Territory, but farther south in Manchuria (the Kirin Province) they are as common as specimens of normal color (A. Sowerby, The Naturalist in Manchuria, II-III, p. 171-172, 1923).

I had the opportunity of studying two partly melanic specimens. One of them (No. M. 3081 female, in my collection) was sent to me by the late A. I. Cherskii, who bought it in the Vladivostok market. The other specimen was given to the Moscow Zoological Museum by V. V. Bogomolov who shot it on the Sikhote-Alin Range (Maritime Territory) 15 km from the village Sol'skii (No. S. 4037). Both specimens belong to the same color type (pl. IV, lower figure).

Color of top of head, area around eyes, cheeks, back, and flanks shining black with a slight brownish tinge.

Throat and lips dirty whitish with a slight straw tinge. A well marked transverse black stripe, about 30 mm wide, beneath the throat. Chest pale pinkish straw (between light pinkish cinnamon and vinaceous-buff, Ridgway, pl. XXIX and pl. XL). Belly white. A diffuse black stripe across the lower part of the belly. Groin white. Inner and outer sides of ears black. Outer fringes of ears dull straw-rust-ocher.

Forelegs black-gray-brown. Hind feet with a mixture of pale straw-ocher and black-brown hair. Tail dark gray with blackish dorsal side.

Melanic specimens are characterized by the presence of some very long silver-straw guard hair contrasting with the general black background of the back and on the flanks.

The melanic specimens are smaller than specimens of normal color. This was confirmed by A. Sowerby (1923).

SYSTEMATIC NOTES. The systematic position of the Manchurian hare is not clear. In the past it was placed in the genus Lepus or in the genus Caprolagus.

After careful examination I came to the conclusion that the genus Caprolagus is well characterized. It should not be confused with the genera Lepus and Allolagus.

In his book "Fossil and Recent Lagomorpha" (1898) C. J. Forsyth Major
includes the following genera in the "Caprolagus group": 1)
266 Caprolagus; 2) Nesolagus; 3) Oryctolagus; 4) Sylvilagus.
He includes in Sylvilagus the following genera: Limnolagus,
Romerolagus, Tapeti, Sylvilagus pr. dict.

The Caprolagus group thus includes all relatively short-legged and short-eared hares with a primitive, elongate bony palate.

This grouping seems quite artificial. In addition to wide geographical separation, each of the species of this group has its specific characters. For instance, the genus Oryctolagus differs sharply from Caprolagus and Sylvilagus.

The taxonomic relationship between the genera Caprolagus and Allolagus is best demonstrated in table form.

C. hispidus Pearson (1848) (from the southern Himalayas) belongs to genus Caprolagus. According to Glover Allen (1927), the following species should be placed in the genus Caprolagus: C. sinensis Gray (1833-1834) from southern China, and C. sinensis flaviventris G. Allen (1927) from Fukien (southeastern China).

The monotypic genus Pentalagus Lyon which includes only the species Pentalagus furnessi Stone (1900) from the Ryukyu Islands is closely related to Caprolagus.

Genus Allolagus	Genus Caprolagus
Ears measured from occiput about as long as the head or longer.	Ears much shorter than head.
Fur soft.	Fur coarse.
Skull slightly convex dorsally in profile. Highest point of cranium behind supraorbital space.	Skull flattened dorsally in profile. Highest point of cranium in the occipital region.
Postorbital processes with anterior and posterior angular processes. Anterior process sometimes poorly developed.	Postorbital proces with only a posterior angular process. Anterior processes completely fused with frontals.
Rostrum long. Nasals measured along oblique line about as long as frontal suture.	Rostrum very short. Nasals measured along oblique line markedly shorter than frontal suture.
Incisive foramina about as long as bony palate.	Incisive foramina much narrower than length of the bony palate.
Interorbital space posterior to postorbital process about 60.4 % of the width of both nasals in their posterior third.	Interorbital space almost as wide as both nasals in their posterior third.

Pentalagus and Caprolagus have the following characters in 267 common: 1) ears very short; 2) fur coarse; 3) bony palate primitive, i. e., very long; 4) incisive foramina narrow; 5) nasals shorter. The skull of Pentalagus is not as flat as that of Caprolagus. Its dental formula is m. $\frac{2}{3}$ instead of m. $\frac{3}{3}$. Pentalagus is uniformly colored, dull black-brown both dorsally and ventrally. Its claws are unusually large especially on the forelegs. Pentalagus is, in our opinion, a well characterized genus.

We place the following species in the genus Allolagus: Allolagus mandshuricus Radde, A. brachyurus brachyurus Temm. (1845) from Japan (Kyushu, Shikoku — southern part of Hono); A. b. okiensis Thos. (1906) from Dogo Island; A. b. etigo Abe (1918) — northeastern part of Hondo Island; and doubtfully A. b. angustidens Hollister (1912) described from one specimen fron Hondo (Tateyama).

J. Abe ("A Synopsis of the Leporine Mammals of Japan" (J. of Sci. of Hirosh. Univ.", Vol. I, p. 54-55, 1931)), attempted to analyze the characters of Allolagus mandshuricus and Lepus brachyurus. He came to the conclusion that L. brachyurus does not belong to the genus Allolagus, and that it is more closely related to Lepus than to Allolagus. It is closely related to the blue hare in his opinion.

We completely disagree with this. J. Abe (1931) compares Allolagus mandshuricus and brachyurus*, and concludes that there are great differences between the two species.

As described in "Zoologischer Anzeiger", 1929, the most characteristic feature of Allolagus mandshuricus is that the nasals are about twice as wide in the middle as the interorbital space posterior to the postorbital processes.

After a new study of skulls I came to the conclusion that this was not exact. It should be formulated as follows:

1) Interorbital space posterior to postorbital processes about 60.4% as wide as both nasals in their posterior third.

We then obtain the following measurements (in mm):

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* These data appear in the "Zoologischer Anzeiger".

	Allolagus mandshuricus	A. brachyurus
Width of nasals in the middle	14.5 — 18	16 — 19*
Width of interorbital space	10.2 — 13.2	11 — 13
Width of nasals in the posterior third	16.3 — 19.2	—

2) Nasals about as long as frontal suture or little shorter:

Length of nasals	32.8 — 37.9	36 — 43
Length of frontals	33 — 41	35.5 — 41

269 3) Width of posterior nasal foramina about equal to length of bony palate. J. Abe and I obtained different measurements of this foramen because J. Abe measured the anterior nasal foramina and I measured the posterior foramina. If we compare mandshuricus and brachyurus according to J. Abe's measurements, there is no difference between the two species:

	Allolagus mandshuricus	A. brachyurus
Width of posterior nasal foramina	11 — 12.8	12 — 14
Length of bony palate	7.3 — 9.2	7.2 — 9

4) Maximal width of incisive foramina about equal to length of bony palate:

Width of incisive foramina	7.2 — 9.9	8.1 — 11
Length of bony palate	7.3 — 9.2	7.2 — 9

5) Incisive foramina about as long as upper diastema:

Length of incisive foramina	19 — 21.8	20.5 — 22.5
Length of upper diastema	20.2 — 23	21 — 25

This comparison shows that there are no significant differences between the skull of A. mandshuricus and A. brachyurus in these characters.

The taxonomic position of the black Manchurian hare. Only a few data on this form have been published. N. M. Przheval'skii mentions the black Ussuri hare in "A Journey to the Ussuri Territory" (Puteshestvie v Ussuriiskom krae), Sankt-Peterburg, p. 258, 1870. Th. Noack ("Wild und Wald in Ost-Sibirien", Der Weidmann, Bd. XXII, No. 48, S. 420, 1891) recorded Caprolagus brachyurus niger Noack, from the lower reaches of the Amur. He did not give a full description, but mentioned only briefly that a small hare resembling the Japanese Caprolagus brachyurus Temm. occurs in this region, but it is black.

In my article "Material on the Systematics of Russian Hares" ((Materialy po sistematike russkikh zaitsev) Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXIII, p. 489, 1922) I named the black Manchurian hare provisionally Lepus mandshuricus subphasa melanontus. I was induced to do this by an interpretation of lower systematic categories given by V. L. Bianki in "The Species and Infraspecific Taxa", (("Vid i podchinennye emu taksonomicheskie formy") Russkii zoologicheskii Zhurnal, I (9-10): 292. 1916.)

It does not seem justified at present to give the black-backed Manchurian hare a specific name. It represents an aberration with rather constant color characters of partial melanism. This form seems to acquire a geographical range. It apparently occurs more frequently in southern Manchuria than in the Ussuri Territory.

This is apparently analogous to the case of the black hamster (Cricetus cricetus) which also predominates (or occurs frequently)

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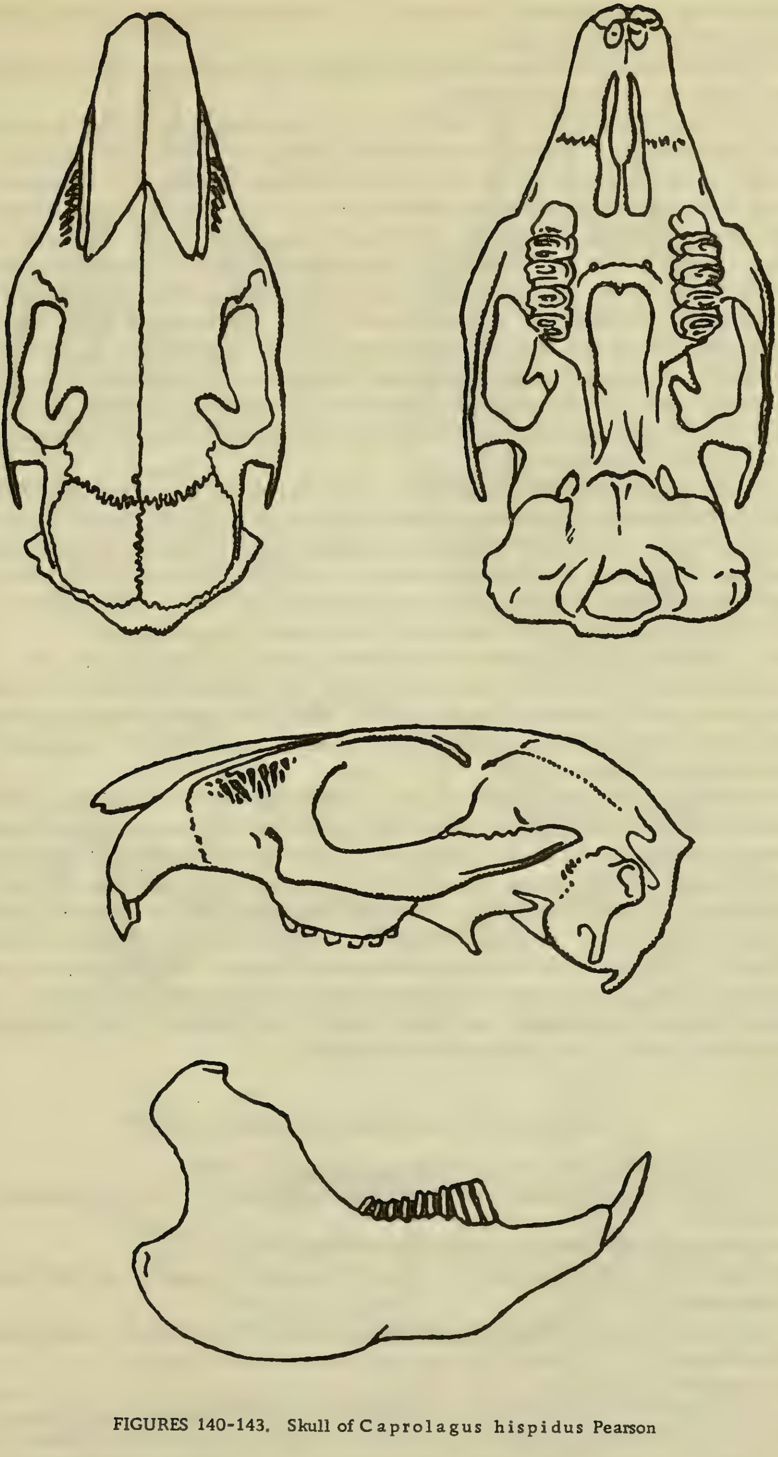
* According to J. Abe.



FIGURES 140-143. Skull of Caprolagus hispidus Pearson

only in some geographical regions. A geographical natio may possibly develop from an aberration.

271 Together with the black-backed melanic form there occur also very rare, completely melanic specimens.

GEOGRAPHICAL DISTRIBUTION. L. mandshuricus occurs in the north as far as the Bureya Mountains (to about 50°N). It occurs throughout the Ussuri Territory to the Korean border. It is apparently widely distributed in northern Manchuria, e. g., in the Kirin Province (A. Sowerby, 1923). It seems to occur at least in North Korea. According to A. I. Cherskii (in litt. 1914) the Manchurian hare occurs frequently near Vladivostok. V. V. Bogomolov (in litt.) often found this species in the Sikhote-Alin Mountains. According to N. T. Zolotarev (1936), the following specimens are in the ZMAN collection: from the Bureya Range (collected by Radde); two specimens from near Khabarovsk (presented by M. A. Menzbir); one specimen from Pokrovskaya railroad station (presented by Bykov); one specimen from Chernigovka (Emel'yanov); two specimens from Sidemi (Yankovskii).

According to G. D. Dul'keit (1938, in litt.) the northern boundary of the distribution of the Manchurian hare follows the bank of the Kop' river*, continues along the Amur river near Verkhnee Tambovskoe, Srednee Tambovskoe. In the west it follows the Bureya Range, Little Khingan and Great Khingan. Its range also includes the basins of the Sungari and Tumen-Ula rivers.

MODE OF LIFE. We know very little about its biology.

A. I. Cherskii (1914) gave the following data: "The habitat of L. mandshuricus is southern slopes of low mountains, i. e., ridges overgrown with forests of oaks, elms, lindens, and various species of maple with shrub undergrowth. One always sees tracks, and wide beaten tracks in such places."

According to N. M. Przheval'skii (1870) this species mainly inhabits islands in the Ussuri river which are covered with osier, and forests in mountain valleys. It never approaches human settlements, even in winter.

G. I. Radde (1862) gives the following data on this species in the Bureya Mountains, "It is remarkable that this species, unlike related species, does not have open lairs. It settles in holes in tree trunks which are open on one side. I found beaten tracks to such a cavity. This animal is very shy during the day. It leaves its shelter when man is still far away. It prefers dense underbrush and osier beds. Its course is as straight as that of the Tolai hare. Its meat is very savory."

Genus **Oryctolagus** Lilljeborg (1873)

1790. Cuniculus Meyer F. A., Magaz. für Thiergeschichte, I, S. 52-53.

272 1873**. Oryctolagus Lilljeborg, Sveriges og Norges Ryggradsdjur, I, p. 417 (as a subgenus of the genus Lepus!).

Ear measured from occiput shorter than head.

Dorsal side of tail black, its color sharply contrasting with that of the ventral side.

Hind legs short. When the animal stands, they seem little longer than the forelegs.

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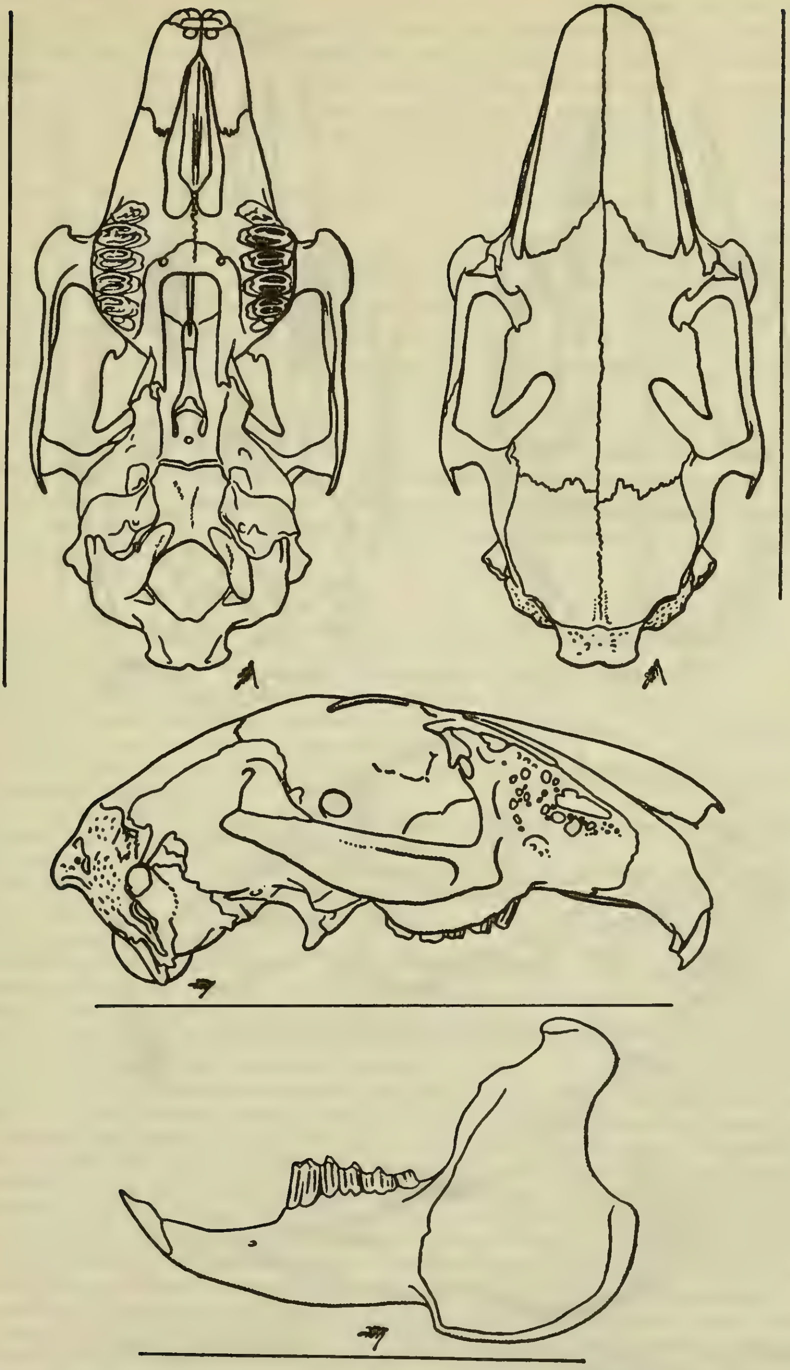
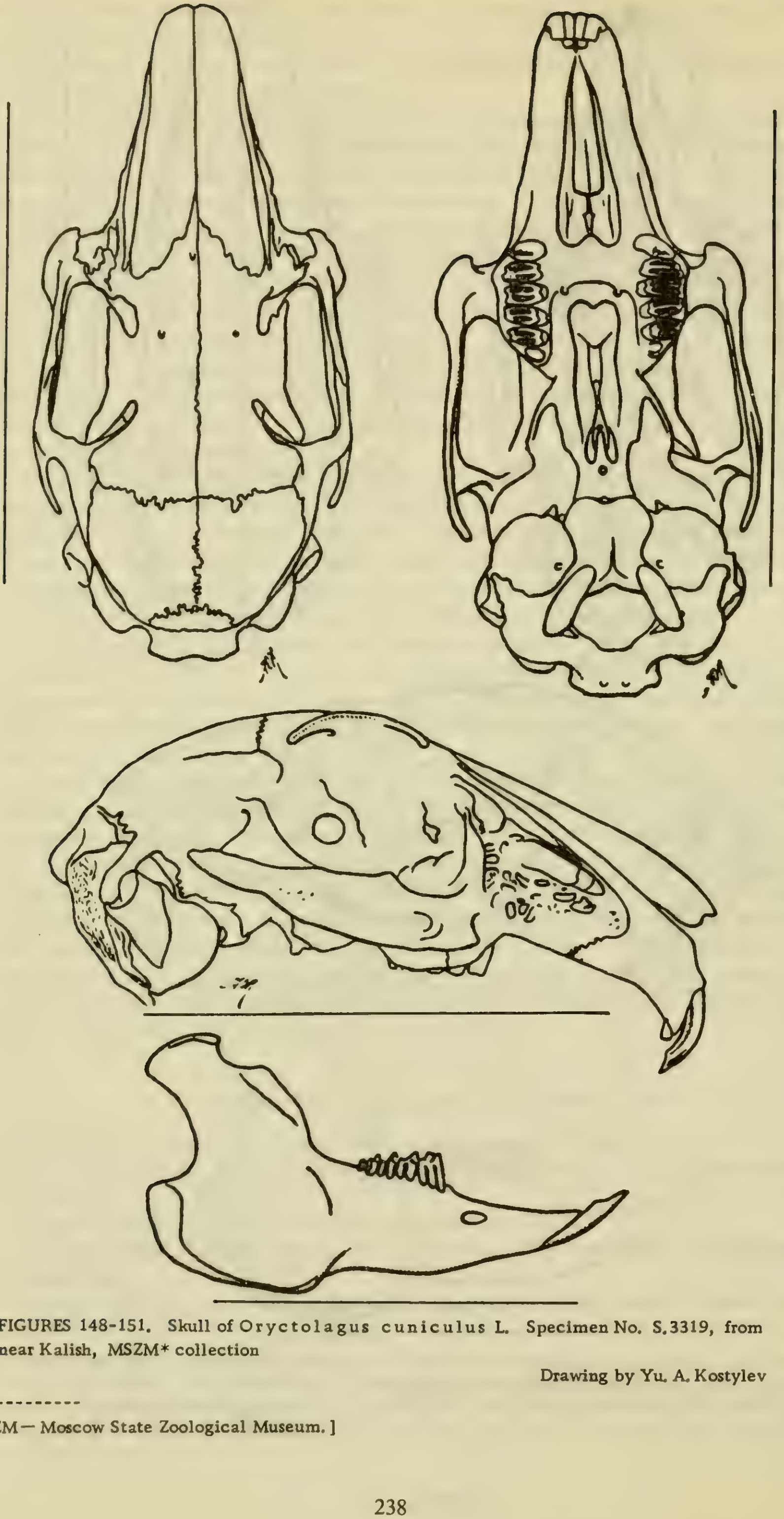
* G. D. Dul'keit found only one blue hare north of the valley of the Kop' river.

** The year 1874 appears on the title page of the book. However, it was published in issues, and the issue with the description of Oryctolagus was published in 1873 (T. S. Palmer, Index generum Mammalium, p. 484, 1904).



FIGURES 144-147. Allolagus brachyurus Temm. No. M.4518. Female ad., 27 January 1935, Nagoya, Hondo, Japan, N. Kuroda, S. I. Ognev's collection

Drawing by Yu. A. Kostylev



FIGURES 148-151. Skull of Oryctolagus cuniculus L. Specimen No. S.3319, from near Kalish, MSZM* collection

Drawing by Yu. A. Kostylev

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* [MSZM — Moscow State Zoological Museum.]

Mesopterygoid fossa much narrower than the length of the bony palate.

Interparietal well developed in adult and old specimens. Postorbital processes narrow, thin, swordlike, not triangular as in many Russian hares.

Ratio of width of interorbital space measured behind the postorbital processes to width of nasals measured in their posterior third about 81%. This is a sharp difference between the skull of Oryctolagus and Allolagus*.

Nasals longer than frontal suture, frontals measured to the anterior process between the nasals.

Width of posterior nasal foramen less than length of bony palate. Anterior nasal foramen about as wide as the length of the bony palate.

Incisive foramina in their posterior part about as wide or slightly less than the length of the bony palate.

Incisive foramina about as long as, or slightly shorter than, upper diastema.

Type species: Lepus cuniculus Linn.

GEOGRAPHICAL DISTRIBUTION. North Africa and the southern and central parts of western Europe. Since about 1850 the rabbit was introduced and multiplied in many countries of the warm region in both hemispheres, e.g., Australia, South Africa, New Zealand and islands of the Pacific and Atlantic Oceans.

162. Oryctolagus cuniculus Linn. (1758). The rabbit

1758. (Lepus) cuniculus Linnaeus C., Systema Naturae, Vol. I, ed. 10, p. 58.
1837. Lepus vernicularis Thompson I., The Athenaeum, p. 468 (nomen nudum!).
1843. Lepus vermicula Gray I., List Spec. Mammal. British Museum, p. 128 (nomen nudum!).
1857. Lepus cuniculus Blasius I., Naturgesch., S. 426-428.
1867. Cuniculus fodiens Gray I., Annals and Magazine of Natural History, ser. 3, Vol. XX, p. 225 (instead of cuniculus!).
1904. Oryctolagus cuniculus Lyon M. W., Classification of the Hares and their Allies. Smiths. Miscell. Collect., Vol. XLV, I, part. 3-4, pp. 402-406.

NAMES: The Rabbit or Cony (English); Das Kaninchen (German); Le Lièvre lapin ou le Lapin (French).

TYPE LOCALITY AND DEPOSITION. C. Linne's "Systema Naturae" (1758) states: "Habitat in Europa australi". G. S. Miller (1912) tries to make this more accurate, and considers southern Germany as type
274 locality. The type is apparently lost.

Principal figures: 1) Schreber I. Ch., Die Säugethiere, Erlang., IV, 1792, S. 891-897, Taf. CCXXXVI, A (entire animal in color); 2) Bingley W., Memoirs of British Quadrupeds, 1809, p. 309 (color. pl.); 3) Blasius I., Naturgesch. der Säugethiere Deutschl. 1857, S. 426-428, Fig. 230; S. 426 (structure of teeth); 4) Brehm A., Zhizn' zhivotnikh (Animal Life), II, 1874, p. 257 (half tone plate); 5) Trouessart E. L., Histoire Naturelle de la France, Mammifères, Paris 1885, p. 189, fig. 79 (entire animal); p. 182, fig. 77 (skull); 6) Fokht K., Mlekopitayushchie (Mammals), Sankt Petersburg 1885, p. 404 (drawing of entire animal); 7) Brehm A. E., Zhizn' zhivotnikh (Animal Life), II, 1893, p. 671 (biological scene); 8) Tullberg Tycho, Über das System der Nagethiere, Upsala 1899, Taf. I, Fig. 1-21 (skull, inner organs); 9) Beddart Fr. E., Mammalia, London 1902, p. 503, fig. 246 (skull lateral and ventral); 10) Millais I. G., The Mammals of Great Britain, Vol. III, 1906, pl. 52 (color), pl. 48 (biological scene), pl. 50 (photograph); 11) Meerwarth H., Lebensbilder aus der Tierwelt, I, Leipzig 1908, S. 45, 47, 49-51, 53-57, 63, 67 (photograph of animals, nests and burrows); 12) Schäff E., Die wildlebenden Säugethiere Deutschlands, Neudamm 1911, S. 122, Fig. 35 (skull ventral); 13) Barrett-Hamilton G., A History of British Mammals, X, 1912, p. 173, fig. 32 (skull); p. 174, fig. 33 (structure of interparietal bone); pl. XII (head of male and female rabbit); pl. XIII (same anteriorly); p. 203, fig. 35-37 (diagrams of burrows); pl. XIV (biological scene); p. 207, fig. 38 (diagrams of burrows); p. 209, fig. 39 (same); fig. 40-42 (same); p. 220, fig. 43 (tracks); p. 230, fig. 44 (skull lateral); fig. 45 (2) (skull); pl. XIX (1) (feet); pl. XX (6) (feet); fig. 48, pl. XIII, p. 315 (4),

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* In Caprolagus the ratio of width of the interorbital space to that of the nasals is about the same as in Oryctolagus

(mandible); 14) Miller G. S., Catalogue of the Mammals of Western Europe, London, 1912, p. 488, fig. 101 (skull lateral, ventral and dorsal); 15) Thorburn Archibald, British Mammals, Vol. II, 1921, pl. 36 (colored); 16) Brauner A. A., Sel'skokhozyaistvennaya zoologiya (Agricultural Zoology), 1923, p. 79, fig. 76 (occipital foramen and structure of palate); 17) Shillinger F. F., Zaitsy — rusak i krolik (Hares — The Common Hare and the Rabbit), 1929, p. 51, figs. 30, 31; p. 52, fig. 33; p. 54 (biological scene); 18) Kuznetsov B. A., Dikii krolik na Ukraine (The Ukrainian Wild Rabbit), "Pushnoe delo", No. 6, 1929, pp. 64-66, figs. 1-3 (diagrams of burrows); 19) Kuznetsov B. A., K voprosu o khozyaistvennom znachenii dikogo krolika na Ukraine (The Economic Value of the Ukrainian Wild Rabbit), "Ukrains'kyi mislyvets ta ribalka" No. 7, 1929, p. 18, fig. (entire animal); 20) Heptner W. G., Zaitsy (Hares), Moscow, 1933, p. 29, fig. 5 (entire animal); 21) Manteifel' P. A., Zaitsy SSSR (Hares of the U. S. S. R.), in "Biology of Hares and Squirrels" (Biologiya zaitsev i belok), Moscow, 1935, p. 26, fig. 1 (1-day old hare).

MATERIAL EXAMINED: 15 pelts and skulls.

DIAGNOSIS. Head relatively large.

Length of outstretched ear measured from occiput less than maximal length of head.

Tail with terminal hair about 94% of the length of hind foot without claws.

In summer and winter fur, dorsal side of tail black, contrasting with white background of the other part of the tail.

Hair not becoming white in winter, remaining brown.

Fur soft. Guard hair soft and straight. Guard hair and hair of undercoat not curly. Teats 6: p. 1 - 1; a. 2 - 2. Total 6.

Nasals measured along line connecting anterior inner corner to outer posterior corner longer than frontal suture. Postorbital process much longer than maximal width of nasals in their posterior part. Width of both nasals about 83% of length of postorbital process.

275 Posterior third of incisive foramina with straight sides, widened, without protuberances.

Ratio of length of bony palate (lateral to anterior process) to maximal width of incisive foramina 100-115%.

Ratio of length of bony palate to maximal width of mesopterygoid fossa 100-110%.

Ratio of length of row of lower molars to that of lower diastema about 87%. Row of lower molars shorter than diastema.

Anterior lower premolar strongly inclined backwards in profile as in the common hare.

Mandibular condyle massive, strongly inclined backwards.

Posterior-ventral plate of mandible (from corner of angular process to notch at beginning of mandibular horizontal process) weakly developed. Distance between corner of angular process to notch at beginning of mandibular horizontal process longer than distance between anterior alveolus of first premolar to tip of lower incisor (not because of the small size of the plate, but because of the short diastema).

Bullae osseae large and inflated, larger than those of Allolagus, and smaller than in desert hares. See Figures 148-150.

Length of skull 76-81 mm (78-82 according to G. S. Miller (1912)); zygomatic width 36-39 mm (37.2-41.4 according to G. S. Miller); length of nasals 33-37.6 mm (35.4-38.6 according to G. S. Miller); width of nasals 11.6-12.6 mm.*

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* In the middle. According to G. S. Miller, maximal width of nasals 14-17.2 mm.

Length of body and head 362-375 mm (392-437 according to G. S. Miller, 1912); hind feet without claws 81-96 mm (87-92 according to G. S. Miller); ear measured from occiput 60-72 mm (65-70 according to G. S. Miller); tail 52-69 mm (47-68 according to G. S. Miller).

ADDITIONAL DESCRIPTION. The cranial characters of the rabbit have been sufficiently described to distinguish it clearly from related species.

COLOR. In summer fur, color of back brownish gray with a slight rust tinge, long and numerous black guard hairs.

Color of top of head generally like that of back but darker because of the greater admixture of blackish hair. Neck dull grayish rust colored with an ocher tinge (between cinnamon (pl. XXIX, Ridgway, 1912), wood-brown and fawn color (pl. XL)).

A broad, light brown stripe across chest. (between avellaneous, pl. XL, and light pinkish cinnamon, pl. XXIX). Flanks, forelegs and two stripes from the flanks to the groin of the same color. Middle of throat and belly white.

276 Color of anterior inner part of ears brownish gray, similar to that of top of head. Outer fringe of anterior inner margin of ears lighter, dull whitish gray. Inner part of ears gray. Posterior (outer) part of ears brownish gray (between drab and hair-brown, Ridgway, 1912).

Black fringe at tip of ears little marked.

Tail white, with contrasting black dorsal side.

Winter fur more luxuriant than summer fur. Color hardly different from that of summer fur, but richer and more rust colored.

SYSTEMATIC NOTES. Two species of rabbits are known: Oryctolagus cuniculus L. and O. crassicaudatus I. Geoffroy, with the following subspecies: O. cuniculus cuniculus L. (Germany), O. c. septentrionalis Franga (Northern Europe), O. c. meridionalis Franga (Portugal), O. c. huxleyi Haeckel (Porto-Santo, Madeira), O. c. habetensis Cabrera (Morocco), O. c. oreas Cabrera (Morocco), O. c. brachyotus Trouessart (estuary of the Rhône), O. crassicaudatus crassicaudatus I. Geoffroy (Transvaal), O. c. curryi Thos. (Orange river), O. c. nyikae Thos. (Niassa, Nyika Plateau).

GEOGRAPHICAL DISTRIBUTION. The wild rabbit was introduced in European Russia, and spread and multiplied in its southwestern part.

A. A. Brauner (1923), in "Agricultural Zoology" (Sel'skokhozyaistvennaya zoologiya) writes: "About 25 years ago gray-brown domestic rabbits were liberated in plantations near Odessa. They multiplied and spread along the Black Sea coast, especially in summer resorts such as Lanzheron, Bol'shoi Fontan, Srednii Fontan and Malyi Fontan, Lustdorf, etc. They settled in the cliffs of the Khadzhibei, Kyal'nitskii and Tiligul'skii limans, as well as in plantations along railways. From here they passed to groves, parks, and orchards near the places mentioned. They are now widely distributed between the Bug and Dniester, and also east of the Bug (Voznesensko-Ratsynskoe Forestry)."

B. A. Kuznetsov (1929) writes that A. A. Brauner told him that the rabbit occurs in the Ukraine as far as the Kodyma river in the north (near Balta, 48° N).

The rabbit apparently spreads eastwards. A. A. Migulin (1927) observed rabbits in the Nikolaev District north of Kherson. The Board of the Kherson Hunting Association informed B. A. Kuznetsov (1929) that wild rabbits occur in the Kherson, Kakhovka, Snigirevka and former Aleksandrovsk districts. At present Oryctolagus cuniculus is found in the right bank Ukraine between Dniester and Dnieper, reaching Aleksandrovsk in the east and the Kodyma river (Balta) in the north.

History of acclimatization of the wild rabbit in the Ukraine. B.A. Kuznetsov (1930) gives some circumstantial data on this subject: "In the spring of 1929 I studied rabbit colonies near Odessa. Local hunters told me that the ancestors of these rabbits were some pairs of western European wild rabbits introduced at the beginning of the century by Graf Malokhovskii 277
from Austria. They were set free on his estate near the Khadzibei estuary. . .

"I received different information from the former manager of the hunting collective of the Kherson Hunting Association, Golubenko. He told me that the ancestors of the wild rabbits in the vicinity of Kherson were seven pairs imported from Switzerland in 1894 or 1895 by the landowner Pin'kovskii. He set the animals free on his estate, 7 versts from Kherson. The Ukrainian rabbit colony possibly developed from several lots of animals introduced from western Europe by different landowners at various times."

The native country of the rabbit is central Europe (reaching the Mediterranean in the south). The rabbit has been widely acclimatized by man throughout the world. However it could not become acclimatized in northern countries which are covered by snow in winter, and in which ecological conditions are unfavorable. According to H. Winge and G. Barrett-Hamilton, it did not become acclimatized in Denmark in spite of a number of attempts. The same happened in Norway. In northern Europe the rabbit is distributed as far as Ireland which has a mild maritime climate.

The rabbit is common on the Azores, Madeira, the Canaries, Porto-Santo and on Selvagens.

Some authors assumed that the rabbit was indigenous to some of these islands. Some of these rabbit colonies were introduced long ago by the Portuguese. For instance, they were introduced to Porto-Santo and Madeira in 1418 and 1419, respectively. The Porto-Santo and Madeira rabbits differ so sharply from the typical wild rabbit that Charles Darwin considered them as a new species formed by insular isolation. The island rabbits are certainly a well differentiated subspecies.

The North African rabbits are probably not indigenous. According to F. Lataste the rabbit does not occur in Tunisia, Algeria or the Sahara but is common in the littoral islands. According to A. Cabrera, the rabbits in Morocco are not indigenous but are descended from animals which were acclimatized long ago. Rabbits also occur in the Chafarinas Islands, in the north Moroccan littoral.

Rabbits were introduced in South Africa (where a separate species developed), in New Zealand and Australia. Several pairs were introduced in Victoria, Australia (1859). They multiplied enormously. Large colonies occupied the pastures of sheep (which constitute the main source of income of the farmers), and destroyed the grass. This enormous multiplication of rabbits became a calamity. Statistics of the Department of Agriculture show that at the beginning of this century there were about 20 million rabbits in Australia. The Australian government expends large sums for the control of this pest.

278 MODE OF LIFE. B. A. Kuznetsov gives descriptions of habitats favored by wild rabbits near Odessa, Kherson and other towns where rabbits survived, became acclimatized and multiplied. In southwestern Russia rabbits live in various habitats. Their typical habitat are large, low cliffs of loose shell-limestone layers. For instance, large piles of broken stone are scattered near the Arkadia summer resort near Odessa, after exploitation of limestone deposits (Kuznetsov's data applied to 1929). These stone piles are used as shelters by the rabbits which live in holes and cracks among the stones.

Rabbits occasionally inhabit cemeteries, where they burrow under the tombstones, for instance near Odessa and Kherson.

Rabbits also settle in orchards on cliffs near the seashore, e.g., on Bol'shoi Fontan in Odessa.

Rabbits are especially numerous near the Luzanovka Health Resort on the sandy slopes of the Zhivakhova Mountain, overgrown by stunted grass. The animals live mainly among the stones of a crumbled wall. Near Berezovka, rabbits occur along ravines of brooks, tributaries of the Tiligul river and in forests. According to A. A. Brauner, rabbits inhabit cliffs at the seashore, banks of estuaries, near railway embankments, ravines, and in steppe forestries. The animals occasionally take shelter in the straw fences around farms.

The forester in the Berezovskii forestry informed B. A. Kuznetsov that rabbits live under large heaps of reeds on his farm.

Rabbits live under special conditions in the outskirts of Nikolaev. B. A. Kuznetsov found a large colony in the yards of the plant imeni Marti. B. A. Kuznetsov writes: "These large yards are between the plant and the bank of the Bug. The upper part of these yards consists of sterile desert covered by coarse alluvial sand with stunted thickets of grass or weeds.

"In the lower part of the yard the vegetation becomes denser and more varied, passing into bulrush and sedge thickets of the coastal belt.

"The whole yard, and especially mounds near the buildings, are covered with scattered heaps of iron, broken machines, heaps of slag, planks, etc. Numerous colonies of wild rabbits find shelter under these heaps of iron and slag. Burrows of these animals are frequent. The burrows pass under blocks of slag of many tons or between parts of broken machines. Burrows are never found on free ground. The sandy ground of the free spaces is covered by a network of tracks. Everywhere there are shallow pits where the rabbits urinate. Some places are completely covered by their feces, as rabbits always defecate in a definite place.

279 "In spite of the proximity of the rattling plant, rabbits are very common in its yards..."

A peculiar rabbit colony exists in caves and old mines of the Verevochnaya Ravine near Kherson. B. A. Kuznetsov writes: "The Verevochnaya Ravine consists of two approximately equal parts. The upper part is narrower and its slopes steeper. The lower part is wider and its slopes are less steep. Strata of loose shell-limestone outcrop in the upper part of the ravine, especially on the left slope. These were formerly quarried, and are therefore full of caves and debris, of various sizes. Some of the caves are so large that a man can walk upright in them. These caves (which are called "skel'") are inhabited by large rabbit colonies which dig their burrows in cracks in the walls. Limestone strata do not outcrop in the lower half of the ravine. The stone quarries therefore consisted of a labyrinth of underground passages connected with the surface by vertical shafts. Many of these underground passages have collapsed, creating deep pits. Shafts into the underground passages open at the bottom of these pits. In these shafts the rabbits are even more numerous than in the "skel's" in the upper part of the ravine."

The rabbit thus does not avoid the neighborhood of man. Owing to its secretive mode of life, its alertness and caution, it knows how to evade danger.

The rabbit is a completely nocturnal animal. According to B. A. Kuznetsov's observations in the Berezovskii Forestry the rabbits emerge from their burrow at about 11.00 p.m. in spring and feed until sunrise (5-6.00 a.m.). According to hunters, the rabbits are active in winter from midnight to daybreak. Where the rabbits are little disturbed, the young occasionally emerge from their burrow during the day to lie before the entrance and bask in the sun. However, rabbits never go far from their burrow. B.A. Kuznetsov writes: "When rabbits settle in orchards, ravines or cliffs on the seashore they usually live in colonies and their burrows are concentrated in a small area. Rabbit colonies are especially numerous in heaps of stones, in stone quarries or under buildings. Rabbit burrows are evenly distributed throughout the territory of the Berezovskii Forestry.

"Near Odessa rabbits dig their burrows in crevices in quarries, under heaps of stone, and under buildings. I was therefore unable to excavate a single burrow in this area. On the other hand I excavated a number of burrows in the Berezovskii Forestry. These burrows are of two types Those of the first type are very simple. They consist of a rounded, widened central chamber, 30-60 cm below the surface, which is connected with the surface by one, generally two (rarely three) galleries 1-2 m long. The size of the central chamber varies. It is usually 40-60 cm wide and 25-40 cm high.

280 "Most burrows of this type did not contain any bedding. Only in two chambers did I find nests of dry grass and moss. The exits usually open directly onto the surface, and are not at the bottom of broad, funnel-shaped pits as are those of the second type. The mounds of earth outside the exits are very small.

"The burrows of the second type are more complicated. They have 4-8 or more exits. Some of them are usually caved in and blocked with soil. Their exits open at the bottom of a deep and broad, funnel-shaped pit which has formed as a result of the repeated collapse of the opening. This proves that these burrows have been used by many generations of rabbits.

"The existence of these two different types of burrows can probably be explained by the fact that burrows of the first type belong to single animals (females and young) while burrows of the second type are used by females to raise their young. This can be decided only by excavating a large number of burrows during the summer. In the Berezovskii Forestry rabbits are often absent from their burrows during the day, hiding under grass or tree trunks where they make "lairs". These consist of small oblong hollows with bedding of dry grass and leaves. They are usually well covered by overhanging branches. The rabbits lie very quietly sometimes letting a man approach to 3-4 steps."

Numerous fecal pellets are usually found near the burrows on small mounds, for example, on molehills. Such "latrines" are also found in the feeding plots.

The food of the rabbit in summer differs sharply from that in winter. From spring to late autumn rabbits feed almost exclusively on green grass. When they live near a vegetable garden they feed on cabbages, carrots, young shoots of cucumbers, melons and watermelons. Rabbits apparently do not touch grain.

In winter they feed mainly on dried weeds and roots of plants. Shallow funnel-shaped hollows on weedy grass plots are often found in winter. These are made by rabbits who dig roots from the ground.

In forest nurseries rabbits feed on bark and young branches of trees. Injuries to bark of trees made by rabbits are easily distinguished from those made by hares. The teeth marks in the bark are always smaller than those of the common hare. Only the tips of branches are bitten off by rabbits.

According to German authors (e.g., the new edition of Brehm revised by Ludwig Heck), the gestation of the rabbit lasts 30 days. This corresponds with data obtained in the Moscow Zoological Garden (P. A. Manteifel', "Hares of the U.S.S.R." (Zaitsy SSSR), 1935, p. 26). According to A. A. Brauner, the rabbit in southwestern Russia has 4 or 5 litters yearly, and each litter consists of 4-8* young. According to B. A. Kuznetsov (1929), each litter 281 consists of 8 young. It is not known whether copulation takes place in the burrow or outside. The young are born naked, blind and completely helpless. Compared with newborn hares they look like embryos. Birth is followed immediately by copulation. This results in more intensive reproduction than that of the hare. If all 8 young of each of the 7 litters per year were to survive and reproduce, the population of rabbits would reach 1,274,840 in four years. This of course never happens in nature, as many are killed by enemies.

The young become sexually mature in their fifth to eighth month, according to the locality. In hot climates they become mature earlier and in the temperate zone later.

Rabbits do not hibernate and are active at night.

They cause much damage to vegetable gardens and melon fields where they are numerous.

In forests the rabbits gnaw young trees and shrubs. The forester of the Berezovskii Forestry told B. A. Kuznetsov that the rabbit is a much more dangerous enemy of the forest than is the hare. Rabbits are especially harmful in tree nurseries in which they may destroy large plantations of poplar, ash, locust trees, maple and fruit trees.

The rabbit has many enemies. B. A. Kuznetsov (1929) explains the reduction of rabbits in southwestern Russia as follows: 1) intensive hunting; 2) exploitation of quarries (stone heaps are a favorite habitat of rabbits), 3) multiplication of enemies of the rabbit, e.g., the fox. In addition to foxes the rabbit is hunted by Martes foina, Mustela putorius eversmanni Lesson, domestic cats and dogs. Young rabbits are frequently caught by buzzards and sometimes by eagles. B. A. Kuznetsov considers the fox the greatest enemy of the rabbit near Odessa.

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* In the last edition of Brehm, Heck gives the figure as 4-12.

The pelts of the wild rabbit are beautiful and are in considerable demand in Russia and abroad. The rabbit has little commercial value because of its narrow range in the U.S.S.R. and its small population.

The rabbits in southwest Russia should be protected: it should be prohibited to hunt them in summer. The damage caused by rabbits can be controlled, and it is inconceivable that we should exterminate them, as some people have requested.

SECOND SUBORDER. SIMPLICIDENTATA

Maxillae with only one pair of large, curved, rootless incisors covered with a thick layer of enamel only anteriorly. Number of premolars $\frac{2}{1}$ or $\frac{1}{1}$; molars $\frac{2}{2}$ to $\frac{3}{3}$.

282 The molars of some species have roots. In other species they have no roots and grow throughout life. The molars are either brachydont or hypsodont. The crowns are either bunoid or lophodont. The distance between the two upper rows of molars is smaller than that between the lower rows. Simplicidentata grind food by longitudinal movements of the rows of molars; lateral movements also take place. The glenoid cavities of Simplicidentata are narrow. As a result the mandible can slide along its axis. The two halves of the mandibles are usually loosely connected by the transverse mandibular muscle. The optic foramina are separate. The size of the infraorbital foramina is variable. They are large in most forms. When the central part of the masseter passes through the infraorbital foramen, its diameter may be very large, almost as large as that of the orbit (e.g., in Hystricidae).

Bony palate complete, consisting of premaxillaries, maxillaries and palatines. Palate with incisive (or palatine) foramina.

Soft palate with only a few folds. Cecum without spiral valve.

Os penis well developed in most forms but sometimes very small.

The extinct family Ischyromyidae is considered intermediate between the Duplicidentata and the Simplicidentata. They lived from the Lower Eocene to the Oligocene.

KEY TO THE FAMILIES OF THE SUBORDER SIMPLICIDENTATA

1 (2). Broad fur-covered fold of skin (parachute) between fore- and hind legs which is supported by a thin bony process as the base of the wrist. The parachute is used for gliding and for leaping from one tree to another.

Pteromyidae

2 (1). Parachute between fore- and hind legs absent.
3 (4). Back and flanks covered with long, hard spines.

Hystricidae

4 (3). The whole body covered with more or less soft hair.
5 (8). Toes of hind legs connected by a bare broad web. Tail squamous.

6 (7). Tail very broad, flat. Anterior upper molar about twice as wide as posterior molars. Skull without postorbital processes.

Castoridae

7 (6). Tail round in transverse section. Posterior upper molar almost twice as wide as anterior molar. Postorbital processes present.

Capromyidae

8 (5). Webs between digits of hind legs absent. Tail more or less densely covered with hair.

283 9 (12). Molars (including premolars) $\frac{5}{4}$ or $\frac{4}{4}$.

10 (11). Molars (including premolars) usually $\frac{5}{4}$, only in Teres (Caucasian-Persian Squirrel) $\frac{4}{4}$.

Tail always without horny scales, shaggy, often depressed dorsoventrally. Tail of arboreal forms with long hair.

Infraorbital foramen small, rounded or rounded-oval. Tubercles on crowns of molars form elevated transverse enamel folds. On intact molars these tubercles are well marked, especially in the marginal parts.

Sciuridae

(Squirrels, chipmunks, susliks, and marmots)

11 (10). Molars (including premolars) always $\frac{4}{4}$.

Tail without horny scales in the majority of species and densely covered with hair. The tail of the genus Myomimus is covered with scant, very short hair through which the scales may be visible. Infraorbital foramina narrow, laterally compressed, elongate vertically. Crowns of molars with numerous transverse enamel folds, without well marked tubercles.

Myoxidae

12 (9). Molars including premolars less than $\frac{4}{4}$.

13 (16). Molars $\frac{4}{3}$; first molar very small.

14 (15). Hind legs not more than 2-2½ times as long as forelegs. Hind feet with 5 normally developed toes. Only the first, inner toe of the forefeet shortened, its tip hardly reaching the base of the next toe. Metatarsals of hind legs free, not fused. Tail squamous, covered with scant hair, very thin and long, without terminal tuft, prehensile, capable of coiling around branches.

Subfamily Sminthinae

15 (14). Hind legs about 4 times as long as forelegs. Hind foot with 2 shortened lateral toes, the tips of which do not reach the bases of the 3 middle toes, or with only three toes. Three central metatarsals fused. Tail without scales, densely covered with short hair, with a well developed tapering terminal tuft ("flag"). Tail not prehensile.

Dipodidae

16 (13). Molars $\frac{3}{3}$.

17 (18). Molars very small, rudimentary; length of upper molar row about 1.5 mm. Molars covered by gums, not taking part in chewing. Food is cut by the enormous, sharp, curved incisors. Anterior surface of incisors with a deep longitudinal groove.

Seleviniidae*

18 (17). Molars normally developed and protruding from the gums.

284 19 (20). Hind feet with two short lateral toes the tips of which do not reach the basis of the three central toes, or with only three toes. Tail long, with a terminal tuft (15) ("flag").

Dipodidae

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* The vernacular name of this family is derived from the "bayalych" plant (Salsola arbuscula). Species of this family are found in thickets of this plant in the Bet-Pak-Dala desert.

20 (19). Hind feet with five normally developed toes; tips of lateral toes always reaching the basis of the three central toes.

21 (22). Eyes rudimentary, covered with skin. No external ears. Tail absent, not visible externally.

Spalacidae

22 (23). Eyes developed but very small in some species (e. g., in Ellobius). External ears present, sometimes small and reduced to folds of skin, forming elevated ridges along the margin of the auditory meatus. Tail present, but very short in some species, e. g., Ellobius.

23 (24). Claws of forefeet very large, thick and curved, particularly those of the three central toes. Claws longer than toes.

Myospalacidae

24 (25). Claws of forefeet normal, sometimes slightly lengthened.

Muridae

Family PTEROMYIDAE, FLYING SQUIRRELS

1855. Pteromyinae Brandt I. F., Untersuch. über die Craniologisch. Entwicklungstufen und Classification der Nager. Mémoires mathém., physiques et naturelles, tome VII, St-Petersburg, p. 151.

1879. Pteromyidae Anderson, Anatom. and Zoolog. Researches, Expedition of Junnan, p. 278.

1904. Pteromyinae Trouessart E. L., Catalogus Mammalium, Supplement, p. 297.

1912. Petauristidae Miller G. S., Catalogue of Mammals of Western Europe, p. 940; Pocock R., On the Classification of Sciuridae, Proceed. Zoolog. Soc. of London, 1923, p. 240.

1930. Pteromyidae Vinogradov B. S., Mlekopitayushchie SSSR. Gryzuny (Mammals of the U. S. S. R., Rodents), Izdatel'stvo Akademii Nauk, p. 22.

These animals resemble squirrels in general. The head is rounded and the muzzle blunt. The ears are protruding and well developed, the tail is covered with long hair. The typical character of flying squirrels is the hairy parachuting membrane. This consists of a fold of skin between the fore- and hind legs. At the outside of the forefeet there is a bone directed laterally and posteriorly, which is as long as the antebrachium in Russian flying squirrels. These bones support the parachute membrane. They are very short in Eupetaurus.

A small antebrachial fold of skin in front of the forelegs. A more or less developed interfemoral fold between the hind legs, which is strongly reduced in Eupetaurus.

Dental formula: $i\frac{1}{1}$; $c\frac{0}{0}$; $p\frac{2}{1}$; $m\frac{3}{3}$ = (22).

285 GEOGRAPHICAL DISTRIBUTION. Forest zone of the northern hemisphere. India, Ceylon, Burma, South China, Sumatra, Java and the southern parts of the U. S. A.* In the north, the range includes a wide area from Scandinavia to Chukchi (Anadyr Basin). In North America the northern boundary of the range of the flying squirrel runs from the Yukon Basin and the lower reaches of the Mackenzie river to the Great Bear Lake and further south to the Great Slave Lake. The boundary continues eastwards along the southern part of Mackenzie State, turning south through northern Manitoba, Ontario through Quebec, ending north of Cape Harrison. The northern boundary of the range of the flying squirrel in Alaska and Canada turns sharply south from west to east.

The family Pteromyidae consists of eleven genera some of which may be regarded as subgenera. The genus Eupetaurus Thos. should be more correctly considered as a subfamily, Eupetaurinae, separate from the subfamily Pteromyinae. O. Thomas[*] showed that the Eupetaurinae should be considered as a subfamily because of their different skull structure and hypsodont teeth with a peculiar form of crown.

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* It reaches the northern part of southern California and Utah in the west, and southeastern Texas and Florida in the east.

The subfamily Pteromyinae includes the following genera[**]: 1) Jomys Thos. (type species J. horsfieldi Waterh.) - Java, Borneo, Malacca; 2) Belomys Thos. (type species B. pearsoni Gray) - Himalayas, Sikkim, Yunnan, Assam, Formosa; 3) Pteromyscus Thos. (type species P. pulverulentus Günth.) - Malacca, Borneo; 4) Petaurillus Thos. (type species P. hosei Thos.) - Borneo; 5) Pteromys G. Cuvier (type species P. volans L.) - distribution given below; 6) Glaucomys Thos.[†] (type species G. volans = Mus volans L.) - North America; 7) Hylopetes Thos. (H. everetti Thos.) - Nepal to the Malay Archipelago; 8) Petinomys Thos. (type species P. lugens Thos.) - India, Ceylon, Malay Archipelago; 9) Eoglaucomys Pocock[††] (subgenus) (type species E. fimbriatus Gray) - Gilgit, Himalayas; 10) Trogopterus Heude (type species T. xanthipes A.M. Edw.) - South China.

Genus **Pteromys** G. Cuvier (1817)

1800. Pteromys Cuvier G., Leçons d'anatomie comparée, recuillies et publiées sous ses yeux, I, tab. I (Nomen nudum!)[‡]

1817. Pteromys Cuvier G., Le Règne Animal, Vol. I (description of the genus); See also Editio II, 1829, p. 194.

286 1822. Pteromys Flemming I., Philosoph. Zoolog., H. p. 190 (See G. S. Miller, Proceed. Biological Society of Washington, 1914, p. 216).

1825. Sciuropterus Cuvier F., Dents des Mammifères, p. 255.

1826. Pteromys Cuvier F., in: Despréaux L., Dictionnaire des sciences naturelles, dans lequel on traite méthodiquement des différents êtres de la nature, XLIV, pp. 40-41.

The animal resembles a squirrel in general but the body is flattened and a parachuting membrane extends between the legs. This will be described in more detail below. There is no parachuting membrane between the hind legs and the base of the tail.

The skull has a large, rounded braincase. The rostrum is short. The sides of the rostrum are nearly parallel in dorsal view. The nasal processes of the premaxillaries are narrow anteriorly and widened posteriorly. The zygomatic arches are widened anteriorly. The zygomatic processes of the maxillaries are broad. Seen from the front they form plates which are slightly narrowed dorsally. Middle parts of zygomatic arches thickened dorsoventrally, forming narrow, horizontal plates.

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[*] O. Thomas, Eupetaurus, a new form of Flying squirrel from Kashmir Journ. of the Asiatic Society of Bengal, Vol. LVII, part II, No. 3, 1888, pp. 256-260.

[**] O. Thomas, The Genera and Subgenera of the Sciuropterus Group., Ann. and Magaz. of Natural History, ser. 8, Vol. I, No. 1, 1908, pp. 1-8.

[†] This and the following genus are considered by O. Thomas (1908) as subgenera of Pteromys

[††] R. Pocock, Classification of the Sciuridae, Proceed. Zoolog. Soc. of London, part I, 1923, p. 241.

[‡] I could not obtain the first edition of "Leçons d'anatomie comparée. There is no description of the Flying squirrel in the second edition (t. II, p. 152, 1837). Cuvier writes as follows: "D'autres mammifères, savoir, les galéopitèques, les polatouches ou écureuils volants, et les phalangers volants, ont des membranes entre les pattes, mais sans alongement des doigts; elles ne peuvent pas servir à les élever, mais elles les soutiennent assez bien en l'air pendant quelques temps de très grands sauts en descendant aux quels on ne peut point donner le nom de vol". According to T. S. Palmer ("Index generum Mammalium", 1904, p. 595) the Flying squirrel is also a nomen nudum in Cuvier's Comparative Anatomy. A description of the genus appeared in "Règne Animal".

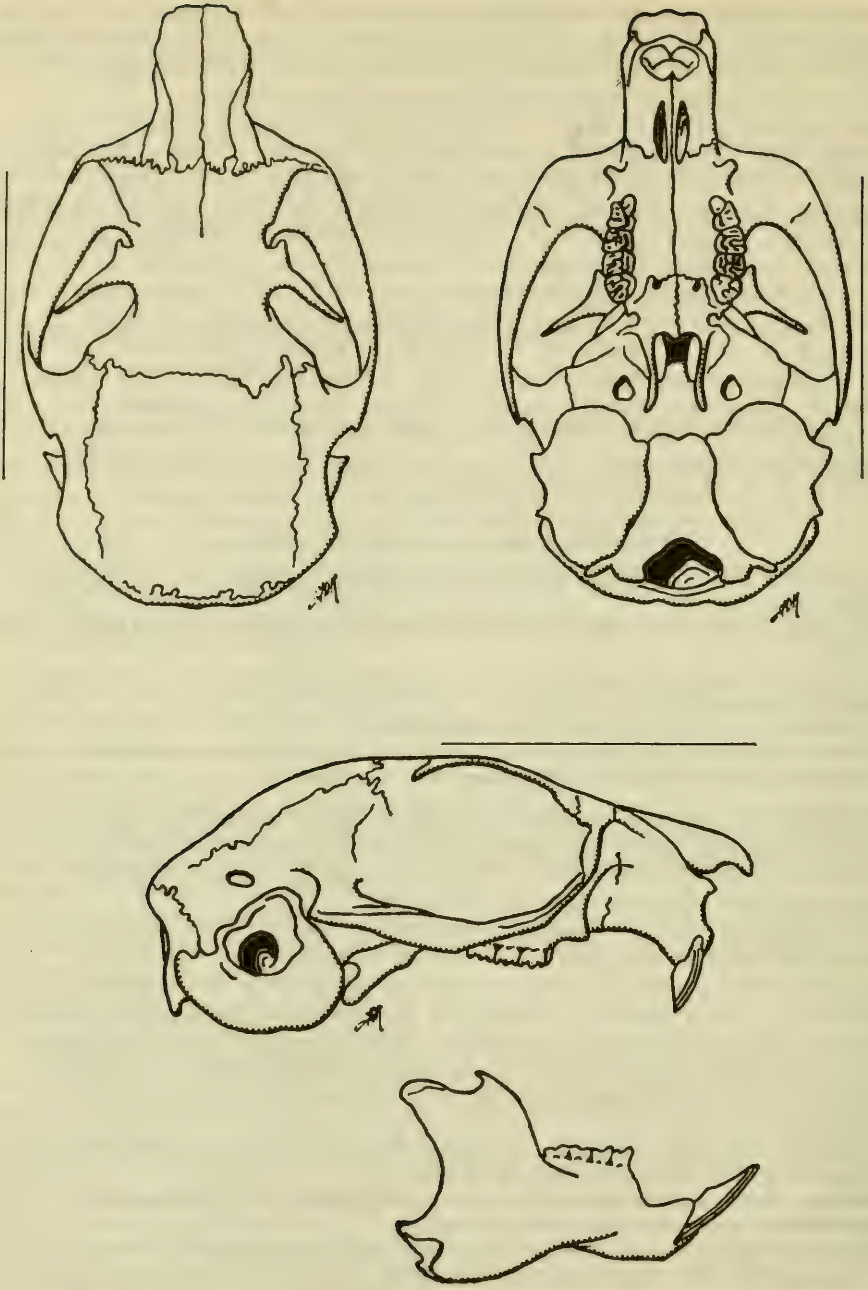

FIGURE 152. Skull of flying squirrel, Pteromys volans L., 18 November 1930, Shar'ya District, Gorki Territory, A. N. Formozov (specimen No. C)

Drawing by Yu. A. Kostylev

Frontals shortened posteriorly, reaching the interorbital space by a little more than the length of the postorbital process. Anterior palatine foramina large. Mandible massive. Angular process very large.

Molars of complex structure. The posterior enamel folds of the upper teeth (from the second premolar) have deep oblique-transverse grooves on the posterior side.

The glans penis of the flying squirrel is very peculiar. It has a slender, fingerlike process which is slightly inclined downwards in profile. The glans bears an oblique row of blunt, horny denticles dorsally.

The os penis is 5.2 mm long. A large lateral denticle at the base of the os penis. Apex of os penis directed downwards.

The structure of the os penis in the American genus Glaucomys differs sharply from that of Pteromys; it has no sharp basal denticle and has a slightly elevated fringe at the side. Its tip is turned upwards. These differences are well shown in figures 153-156.

There are also great differences in the skull and in the structure of the teeth between the palearctic Pteromys and the American Glaucomys*. The sides of the rostrum converge anteriorly in Glaucomys: the rostrum is thus markedly narrowed anteriorly. The nasal processes of the premaxillaries are slightly narrowed anteriorly. The zygomatic arches
287 are not widened anteriorly and are comparatively narrow. The zygomatic processes of the maxillaries are narrow. Seen from the front, they form plates which are narrower dorsally. The middle parts of the zygomatic arch are not dorsoventrally depressed. They are vertical, narrow plates. The frontals are lengthened posteriorly and reach beyond the orbital constriction by more than the length of the postorbital process. Anterior palatine foramina small and narrow. Mandible weak. Angular process relatively much smaller than in Pteromys.

Structure of molar teeth simplified. Posterior enamel ridges of upper teeth (from second premolar to last molar) without grooves.

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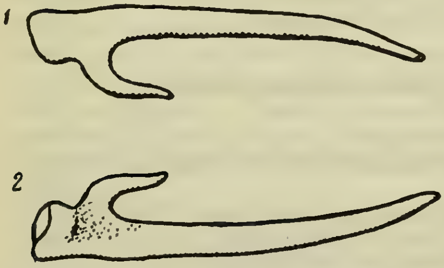

FIGURE 153. Os penis of Pteromys volans L.

1 — lateral; 2 — ventral
From a specimen collected by I. S. Slesarev in the Central Reserve (former Belyi County, former Smolensk Province). Highly magnified.

Drawing by Yu. A. Kostylev

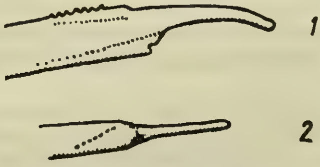

FIGURE 154. Glans penis of Pteromys volans L.

1 — lateral; 2 — dorsal.

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* Comparison of material confirmed the observations of A. Howell (Revision of the American Flying Squirrels, North Amer. Fauna No. 44, 1918, p. 15.

Type species: Sciurus (Pteromys) volans Linnaeus.

288 It is difficult to decide how many species belong to this genus. Pteromys büchneri Satun. from Kansu is in our opinion a good species. The position of Pteromys filchenerinae Matschie from Sining (southeast of Kuku-Nor) is not quite clear. It was described from only one badly preserved skin, without skull.

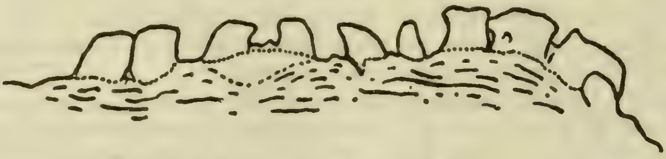

FIGURE 155. Denticles on glans penis of Pteromys volans L. (lateral)
Drawing by Yu. A. Kostylev

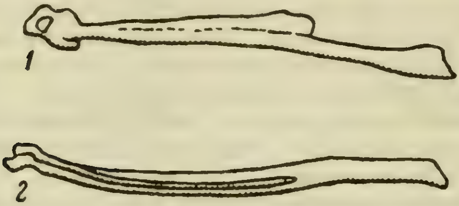

FIGURE 156. American flying squirrel, Glaucomys volans L., Os penis

1 — ventral; 2 — lateral.

Pteromys momonga Temm. from Japan is probably a subspecies of P. volans L.

GEOGRAPHICAL DISTRIBUTION. Eurasia. The southern boundary of the range is shown on Map V. In the east Pteromys occurs in Manchuria, northern and central China, Korea and Japan.

163. Pteromys volans L. (1758). Common flying squirrel

1758. Sciurus volans Linnaeus C., Systema Naturae, ed. X, p. 64.

NAMES: Flying squirrel (English); Flatterhörnchen, das fliegende Eichhörnchen (German); Polatouche (French).

LOCAL NAMES: Mysh' parikha, parusha, parikha (Russian hunters); palyaur (Komi-Zyryan); kiznir (Permyak); pulo, or pulokh (Votyak); bobontol (Man'sy, Vogul); tulmneine (Khanty, or Ostyak along the
289 Ob); ive-lanki (along the Irtyn); pailanglangi (along the Surgut); poeze (along the Narym and Ket'); sartyin (Bashkir); nyar-brod (Komi-Zyryan); maskalan (Yakut); netyagi, or detyagi (Yakut name of Russian origin); ummukki (Tungus); tumr, tumarsh (Nivkhi, Gilyak of the western coast of Sakhalin Island); alvilanga (Nivkhi, Sakhalin); Khongmo (Mangun, Nanai-Gold, Samagir); umugi (Udehe on the river Khor); omke (Nanai-Gold on river Goryun); omoki (Kil and Kuril); umki (Birar and Manyagr); notaga (Nani, Orochis); olbo (Mongolian); khilov (Buryat); tznugo (Ainu); tieke (Yukagir, Odul); ot'to-napral'gyn (Muravetlan, Chukchi); yambe-khull, umbekhull, fei-shu [flying rat] (Chinese).

PRINCIPAL FIGURES: 1) Schreber J. Ch., Die Säugethiere, Erlangen, IV, 1792 S. 813-818, Taf. CCXXIII (entire animal in color); 2) Dwigubski I., Opyt estestvennoi istorii vsekh zhivotnykh Rossiiskoi imperii (A Natural History of the Animals of the Russian Empire), 1829, pl. 19 (entire animal); 3) Simashko Yu., Russkaya fauna. II (Russian Fauna. Vol. II) 1851, pp. 597-599, pl. 133, fig. 1 (in color); 4) Blasius J., Naturgeschichte der Säugethiere Deutschland's, 1857, S. 269-271, Fig. 152; S. 268 (half tone plate); 5) Brehm A., Zhizn' zhivotnikh. II (Animal Life), Vol. II, 1874, p. 64 (half tone plate); 6) Kobel't V., Geograficheskoe raspredelenie zhivotnikh (Geographical Distribution of Animals), 1903, p. 75 (half-tone plate of entire animal); 7) Miller G. S., Catalogue of the Mammals of Western Europe, 1912; pp. 941-946, fig. 195; p. 943 (skull lateral, dorsal and ventral); p. 945, fig. 196 (molars); 8) Meerwarth H. and Soffel K., Lebensbilder aus der Tierwelt, III, Leipzig, 1912, S. 305, 307, 309 (photograph of animals); 9) Rajewski W. W. and Kaplanoff L. G., Übersicht der Säugetiere der oberen Volga, Zoologischer Anzeiger Bd. 84, H. 5/6, 1929, S. 148-150, Fig. 1, S. 149 (photographs of winter and summer skins); 10) Serebrennikow M. K., Ein Flatterhörnchen aus dem Kirgisengebiet, Ztschr. für Säugetiere, Bd. 4, H. 3, 1929, S. 142-143; Taf. XIII (photograph of entire animal); 11) Argyropulo A., Opredelitel' gryzunov Ural'skoi oblasti (Key to Rodents of the Ural Region), 1931, p. 66, fig. 80 (dorsal view of animal); 12) Vinogradov B. S. and Obolenskii S. I., Vrednye i poleznye v sel'skom khozyaistve mlekopitayushchie (Harmful and Useful Mammals in Agriculture), Moscow, 1932, p. 38, fig. 21 (drawing of entire animal); 13) Kuznetsov B. A., Tovarovedenie pushno-mekhovogo syriya SSSR (Marketing of Undressed Pelts in the U. S. S. R.), Moscow, 1932, p. 377, fig. 79 (photograph of dorsal side of pelt).

MATERIAL EXAMINED: 211 specimens (112 specimens in the ZMAN collection; 75 specimens in my collection and from material put at my disposal; 20 specimens in the MSZM collection).

DIAGNOSIS. Generally resembling a squirrel but its body is more flattened. Body covered with very soft, silky hair. Tail also more flattened than that of squirrel. Parachuting membrane between fore- and hind legs covered with dense hair. Parachuting membrane supported anteriorly by a thin, pointed, swordlike bone at the side of the base of the forefeet which is directed laterally and backwards*. When the parachute is stretched, it therefore protrudes markedly laterally.

Head small, rounded. Muzzle blunt. Eyes black and relatively large. Tips of ears without long hair which forms tufts in the winter fur of squirrels.

Ears resemble that of squirrel but are more convex anteriorly, their tips narrower and the outer dorsal margin has a broader notch. The ears of the flying squirrel are broader but shorter than those of squirrels (Figure 158).

Tail without terminal hair, about 3/4 to 2/3 of the length of body and
290 head. Hair on the tail much shorter than in squirrels. These hairs are soft, silky and luxuriant.

Legs shorter and thicker than in squirrels. Forelegs almost bare in summer. Covered with soft, silky hair posteriorly and laterally only. Forefeet in winter densely covered with silky hair. Ventral sides of toes also covered with hair. Soles of hind feet both in summer and winter covered with dense, soft and silky hair. Bare calluses at the base of toes in summer. Ventral sides of toes also bare. In winter specimens calluses at base of toes of hind feet densely covered with soft hair. Ventral side of toes also covered with soft hair. Hind feet much larger than forefeet.

291 Forefeet with three calluses at the base of the toes and two calluses in the posterior part of the palm. The inner callus is larger, the outer relatively small (Figure 159, left). Tips of toes with small tubercles which are smaller than in squirrels. Forefeet with 4 toes. Inner toe shortest, slightly shorter than the outer toe. The 2 middle toes are of about equal size, the inner slightly larger than the outer. Both middle toes much longer than the lateral toes. Claws of forefeet short. Claws of middle toes about 3 mm long (not measured along the curvature).

Four rounded oval calluses at the base of toes in the hind feet. Tips of toes with large tubercles. Hind feet with 5 toes. Inner toe short, much shorter than outer toe, which is shorter than the 3 middle toes. The length of the 3 middle toes increases gradually from the inner to the outer toe. Length of claws of middle toes 2.5-3 mm.

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* This bone is almost as long as the antebrachium.

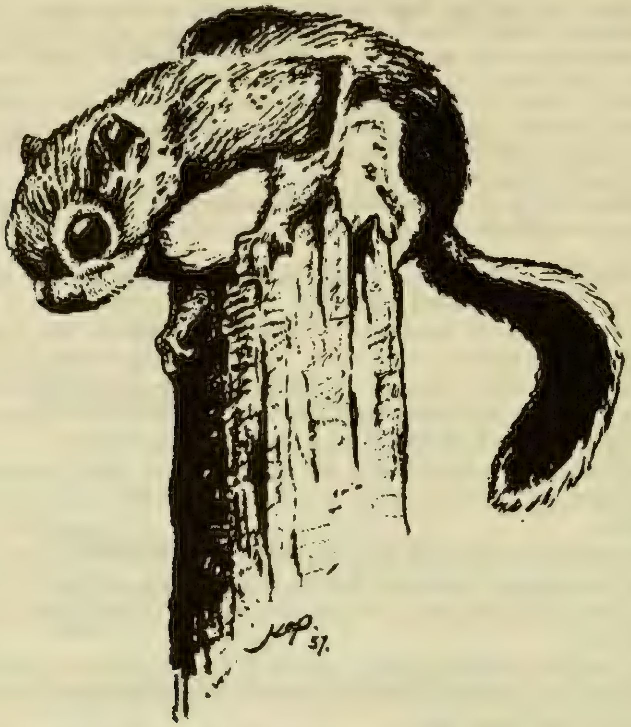

FIGURE 157. West Siberian flying squirrel

Drawing by K. K. Flerov

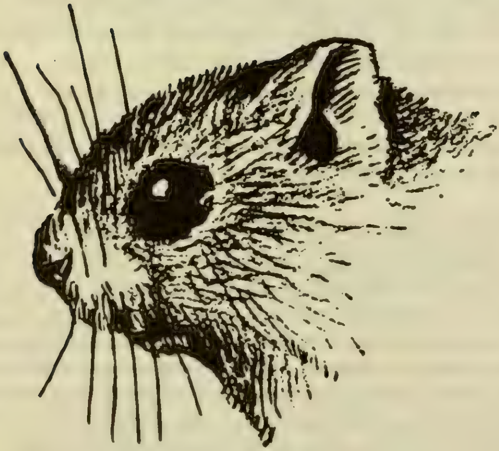

FIGURE 158. Head of flying squirrel, Pteromys volans L.

Drawing by A. N. Formozov

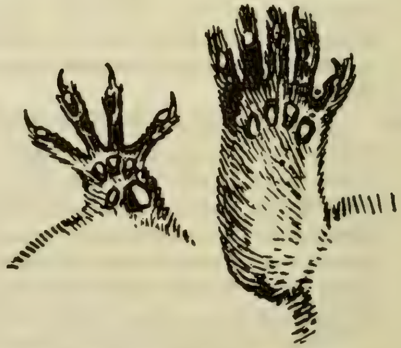

FIGURE 159. Ventral side of feet of flying squirrel

left — forefoot; right — hind foot.

Drawing by A. N. Formozov

Belly white with a more or less marked straw or rust tinge. The white color of the belly mixed with gray in young specimens. Color of summer fur on back between straw-gray-yellow to blackish gray. Winter fur of pale specimens light silvery-gray, sometimes with a yellow-straw tinge. Color of back of more deeply colored subspecies dark ash-gray with a light straw tinge.

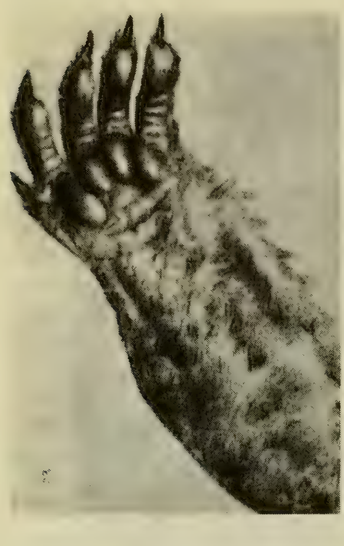

FIGURE 160. Hind foot of Sakhalin flying squirrel, Pteromys volans athene Thos. Post Korsakovskii [Korsakov], Sakhalin

Photograph by S. I. Ognev

Fur silkier and softer than that of squirrel. Margins of parachuting membrane with a well marked fringe of soft hair. Color of tail variable, but less so than in squirrels. In subspecies with dull-colored tail, the general tone of the dorsal side pale whitish gray. Subspecies with straw-rust-colored tail occur in East Siberia. The dorsal side of the tail of dark flying squirrels is dark brownish gray.

Vibrissae in several groups. The main group consists of long black vibrissae on the muzzle in front of the eyes. They are up to 60 mm long and there are 12-14 hairs in each group. Above this group there are 3-4 vibrissae on each side of the forehead.

A few smaller vibrissae are present above the eye. One group near the external side of the eye and behind it.

Rostrum very short. Nasals rounded anteriorly. They seem slightly elevated and terminally inflated in profile. Margins of rostrum parallel.

292 Frontal processes of premaxillaries narrowed anteriorly and considerably widened posteriorly.

The frontal processes of the premaxillaries in their posterior part are slightly wider than the nasals in the posterior third.

Zygomatic process of the maxilla widened and projecting in dorsal view.

Interorbital space narrow, its width 1/3-1/4 of the condylobasal length.

Bullae osseae always longer than wide, strongly inflated, especially anteriorly. Auditory meatus large. Bullae laterally compressed in front of the auditory meatus.

Upper tooth row much shorter than bullae.

ADDITIONAL DESCRIPTION. Rostrum very short. Zygomatic arches rounded, markedly widened anteriorly by the zygomatic processes of the maxilla.

Interorbital space narrow. Braincase large and relatively long. Distance between the narrowest place posterior to the postorbital processes and the highest point of the occiput much greater than that between the constriction and the tip of the nasals. This ratio is the opposite in squirrels.

293 The anterior half of the nasals widened, rounded and slightly inflated. This is clearly seen in profile. Lateral margin of each nasal descending to the premaxillary in a rounded lobe. The anterior part of the nasal is therefore wedge-shaped. Premaxillary frontal processes much widened posteriorly, narrowed anteriorly. The anterior part of the frontals begins

to taper at about the anterior margin of the maxillary zygomatic processes, i.e., where these processes border the premaxillary frontal processes laterally and anteriorly.

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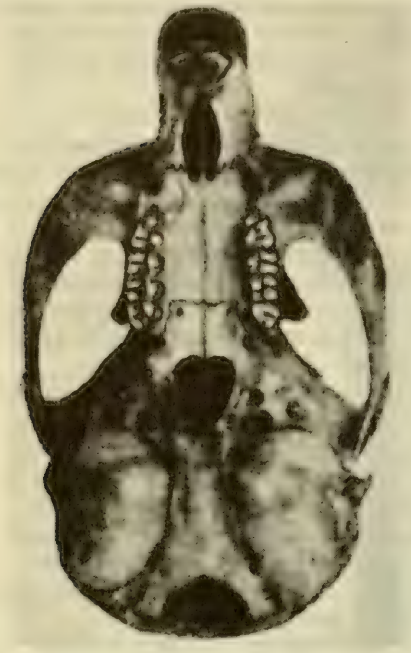

FIGURE 161. Skull of Pteromys volans volans L., 18 November 1930, Sharya District, northern Gorki Territory

Photograph by S. I. Ognev

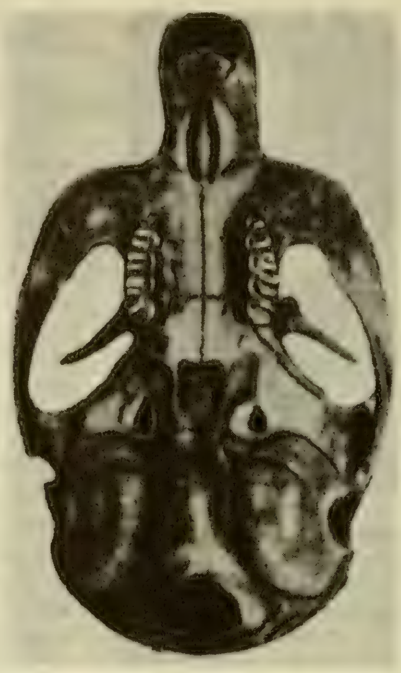

FIGURE 162. Skull of Pteromys volans athene Thos., Post Korsakovskii [Korsakov], Sakhalin Island

Photograph by S. I. Ognev

293 This constriction results in almost parallel margins of the rostrum.

Zygomatic arches evenly rounded. Anterior part of zygomatic arches not quite as wide apart than the posterior part. Maxillary zygomatic processes markedly widened, making the anterior part of the zygomatic arches massive. This is particularly marked if the skull is seen from the front.

The frontal and sagittal sutures are almost straight or convex anteriorly. There is sometimes a backwards directed, angular protuberance lateral of these sutures. A similar protuberance is sometimes present in the middle of these sutures.

Upper molar row about as long as diastema.

Bullae osseae inflated, almost twice as long as wide, markedly widened and rounded anteriorly, compressed laterally in front of auditory meatus.

Molars with transverse enamel folds alternating with grooves. Inner margin of each molar with a small, curved elevation.

First upper premolar much larger than in squirrels. It generally looks like a small pillar near the anterior margin of the second premolar. Base of anterior premolar slightly inwards of the tooth row. Crown of pm^1 simple, with one denticle. Inner side of surface of pm^2 with curved or pectinate elevation. Together with the elevations of the other teeth, they form an almost continuous denticulate crest along the inner side of the tooth row.

Outer side of anterior premolar with three elevations. The middle elevation larger than the lateral ones. Transverse enamel ridges corresponding to this elevation run to a small inner curved elevation on the inner side of the tooth. Posterior transverse enamel ridge broken by an oblique groove which divides it into two cusps.

The first premolar is almost as large as the first upper molar which resembles the second premolar, but there is a depression on the second transverse enamel ridge at the part of the ridge joining the small inner curved enamel elevation at the inner side of tooth. Structure and size 294 of second molar like that of first molar. Last molar smaller, narrower towards the inner margin. The first transverse enamel ridge of the last molar is less well developed. Second enamel ridge identical with that of the preceding tooth. A depression in the posterior part of the last enamel ridge (Figures 161-162).

Structure of lower molars. Outer side of premolar with two denticles. Anterior denticle higher than posterior. Both denticles connected at the inner side by a small enamel bridge. A very small denticle in the center of the bridge.

Inner side of premolar with two denticles. Anterior denticle larger than posterior. An additional denticle inwards of the posterior denticle. Structure of the two first molars generally like that of the premolar. The molars however, are generally larger. A well-marked depression between the outer and inner denticles, in the center of the tooth. This depression is particularly large in the long posterior molar. The posterior denticle (posterior to, and inward of, the second inner denticle) is better developed than on the preceding teeth.

A description of the color has been given in the diagnosis of the species. Details and specific color characters will be given in the description of the subspecies.

GEOGRAPHICAL DISTRIBUTION. The northern boundary of the range of Pteromys volans crosses Russian Lapland, turning south towards the east. According to I. F. Brandt ("Mammals of North European Russia" (Pozvonochnye severa Evropeiskoi Rossii), 1856, pp. 31-32) the flying squirrel was distributed as far as Finnmark. However, this has not been confirmed by later authors. F. D. Pleske (1884) writes that this species does not occur near Lake Imandra. Fellmann observed the flying squirrel in Kuusamo, near 67° N. The northern boundary follows 66° N in Karelia, and 68° N near Kem. It touches the northern Arkhangelsk tundra reaching the Mezen and Kuloi rivers. The flying squirrel is rare in forests along the Kuloi river (B. M. Zhitkov, 1904). Farther east the boundary is not clear. It crosses the Pechora at 66° N reaching the Urals. The boundary apparently turns south in the northern Urals. Small numbers of this animal occur in the basin of the Lyapin. It rarely reaches the Synya river. It is common along the Sosva river (K. K. Flerov, 1933). Farther east the boundary runs to Berezov and continues in the forests along the Kazyma river. The northern boundary of the flying squirrel in the east is not known. However it does not enter the stunted forests of the tundra. The boundary turns south in an arc reaching Yanov Stan (near 66° N, where the flying squirrel was recorded by S. P. Naumov, 1931). Near the lower Yenisei the boundary passes near 68-69° N. It then continues eastward at

295 this latitude through Lake Zhesei and the upper reaches of the Anabara, and reaches the Olenek river (R. Maak, 1859). The boundary then crosses the Lena and Yana rivers at about 70°N. It turns south along the Indigirka and Kolyma rivers to 68°N. In the Anadyr Territory the flying squirrel is found along the Maina and Anadyr rivers (at about 65-66°N).

The southern boundary includes Lithuania passing north of Vilnius, passes Minsk in the north and reaches Mogilev and Polotsk. Farther east it turns south to Dorogobuzh, Yelnya and Roslavl. It then turns to include the Belyi, Rzhev and Dmitrov forests.

From Moscow the boundary turns south to Yegor'evsk, includes the Murom forests and reaches Arzamas, Kazan, and Yelabuga. It then follows the left bank of the Belaya river, turning sharply south to 52°N on the Urals where it passes between the Sakmara and Ik rivers. Farther east the boundary turns again to the birch groves of Shadrinsk and Chelyabinsk. It is difficult to say where the southern boundary passes between Petropavlovsk and Omsk. Flying squirrels apparently do not occur in the Borovoe Forestry (south of Kokchetav). They occur farther east in the isolated birch groves north and west of Pavlodar. Farther southeast the flying squirrel is found in "ribbon" pine forests on the right bank of the Irtysh (e.g., in the Shulbinskii, Srostinskii forests, etc.), that is, in typical habitats of Sciurus vulgaris exalbidus Pall.

Farther south the boundary includes the Altai and Sayan mountains, runs to the southeastern shore of Lake Baikal, and includes northern Mongolia (vicinity of Mondy, Sungur Ravine). The flying squirrel does not occur in the Daurian Steppe. The range is interrupted on the Hentey Mountains. Farther east the boundary passes between the Shilka and Argun rivers (latitude of Nerchinsk), includes the northern part of the Khingan Range and curves to include the forests of Manchuria (from Tsitsihar and Kirin). Farther south the boundary crosses the upper reaches of the Liao Ho and Lwan Ho rivers, reaches Peiping (Peking), and the Chinese provinces Shansi, Shensi, and Kansu, as well as Chihli [Hopei] and Shantung. The range of the flying squirrel covers Japan (islands Honshu, Yezo, [Hokkaido]) and the Russian and Japanese parts of Sakhalin.

According to E. Lubicz v. Niezabitowski (1934) the flying squirrel formerly occurred in north Poland, near Wilno [now Vilnius], but it disappeared from this region long ago. According to L. Taczanowski (1887) it occurs in the Lithuanian forests and was caught near Borisov (former Minsk Province). It occurs in small numbers in the Mogilev forests. J. Domaniewski recently recorded it from Lithuania and Kurland. G. Schweder (1881) recorded it from forests near Kokenhusen [Koknese] and P. Wasmuth (1908), from former Kurland.

According to A.V. Fedyushin (1929), it survives in small numbers in the
296 southwestern territory only in the Vishera and Polotsk districts. In the Mogilev District it was found only in the Belynicheskoe forest.

Farther east we find the flying squirrel in forests of the former Smolensk Province. According to V.A. Melander (1926) it now occurs only in the northern part of this province, in the Belyi and Demidov counties, and sporadically in other counties (Dorogobuzh County). M.I. Pogodin found here a colony of about 20 flying squirrels in a mossy marsh with small pine trees near the village Roslavka. It was also found in the southern part of the former Yelnya County near village Zabolot'e (54°15'N). This is the most southern record in this province. G.L. Grave (1926) writes that small numbers occur sporadically in the northwestern part of the former Belyi County of the Smolensk Province.

In a later publication ("Commercial Hunting in the Western Region" (Okhotnich'i promysly v Zapadnoi oblasti), Smolensk 1933, p. 63) G. L. Grave writes that the flying squirrel is sometimes common in forests of the northern part of the Western Region. It was also recorded from central regions such as Rudnya, adjacent to the Demidov, Saratov, Yelnya, Yekimovichi districts. It occurs rarely and sporadically in forests of the southern parts of the Western Region. G. L. Grave recorded it here from the following places: Akulichskaya and Kleshnyanskaya wood lots of the Lyudinkovskoe Commercial Forestry, the Svenskoe and Beloberezhskoe forestries, some forests of the Roslavl, Sukhinichi, and Yershichi districts. The flying squirrel was found in 1913 in forests of the Korochizhsko-Krylovskoe Forestry. South of these districts the flying squirrel apparently occurs in forests of the former Karachev County of the Orel Province. K. F. Kessler (1858) writes that a flying squirrel was caught in October 1851 in the Karachev County. S. N. Gorbachev (in "Nature of the Orel Territory" (Priroda Orlovskogo kraya), 1925, p. 452) writes that he found in the collection of the former Orel Military School a specimen with the label "Karachev County, 1856". Gorbachev thinks that this specimen was obtained by A. S. Tarachkov. According to K. A. Satunin (1895), the flying squirrel rarely occurs farther northeast in the former Bogorodsk County of the former Moscow Province (near the boundary with the former Yegorevsk County of the Ryazan Province). It was once caught in the Sokolniki near Moscow. I received one specimen from V. G. Durov from the former Dmitrov County of the Moscow Province and gave it to the MSZM. According to V. V. Raevskii (1929), a flying squirrel was caught near Verbilki (former Dmitrov County), near Rasheniya (former Leninskii County, in the Tugolesskoe and Kipriyanovskoe forestries).

According to V. A. Varentsov (1919), it is rare in the former Pereyaslavl County of the Vladimir Province. In my collection are pelts from near the village Zabolot'e (between the former Aleksandrovsk and Pereyaslavl counties of the Vladimir Province). It was stated that flying squirrels are common in this region.

Flying squirrels are also common in the forests occupied by the hunting collective "Dynamo" near the Novye Petushki railway station (former Pokrov County of the Vladimir Province). In this area flying squirrels keep to definite localities. K. S. Satunin ("Primitiae Faunae Mosquensis", 1892, p. 2) writes that the flying squirrel occurs rarely at the boundary between
297 the Moscow and Ryazan provinces. S. S. Turov (1925) records it from the Yegor'evsk County (from a specimen in the MSZM). According to E. A. Bekshtrem (1927), it occurs in the Meshchera forests. L. G. Kaplanov and V. V. Raevskii (1928) write that the flying squirrel is common near Krivyandino railway station in the Tugoles Forest, former Yegor'evsk County and near Lake Svyatoe, former Ryazan Province. According to these authors* it occurs farther north in the upper reaches of the Mologa and also in the former Bezhetsk County of the Tver Province. L. P. Sabaneev (1868) writes that the flying squirrel occurs in the former Poshekhon'e-Volodarsk County. It occurs more or less sporadically in the

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* W. W. Rajewski und L. G. Kaplanow, Zoolog. Anzeiger, Bd. 84 H. 5/6, 1929, S. 148.

other counties of the former Yaroslavl Province. One specimen was caught 30 km from Yaroslavl on the boundary with the Uglich County. Another was caught in the Uglich County not far from the boundary with the Romanovskii County. Another was caught in the Romanovskii County (along the Uglich Highway). According to A. V. Shestakov (1926), about 400 pelts obtained in 1924-1925 by hunters of the Uglich County were stored. Flying squirrels were also found in the Varegovo Marsh and near the village Talovinkino in the Uglich County. According to K. A. Vorob'ev (1927), it occurs in the former Kostroma Province. A.N. Formozov (in litt., 1935) writes that the flying squirrel is very common in forests near Ponazyrevo railway station, Vetluga County of the Kostroma Province. S.U. Stroganov (in litt.) found it near Lake Peno (former Ostashkov County of the Tver Province). It is rare near Vyshni-Volochek. Chistovskii ("The Pskov Territory" (Pskovskii krai), 1927) writes that the flying squirrel is rare in the forests of the Velikie Luki and Kholm counties. According to K. F. Kessler (1885) it occurs in the former Vologda, Novgorod and Petersburg Provinces. V.N. Shchegolev (1925) recorded it from forests near Cherepovets.

Specimens from the Leningrad (former Petersburg) Region are in the ZMAN collection. K. F. Kessler (1868) states that the flying squirrel is found in the former Olonets Province, where it is much rarer than the squirrel.

In the north it occurs in Finland (I. F. Brandt, 1856), in the Kuusamo District (Fellmann) and rarely in forests along the Kuloi (B. M. Zhitkov, 1904).

Distribution of the flying squirrel in the Volga Region. According to A.N. Formozov (in litt., 1935), it is common in the former Balakhna, Makaryev and Semenov counties of the Nizhni Novgorod Province. I saw a specimen from the bank of the Vetluga, northern part of the former Semenov County, Nizhni Novgorod Province.

According to M.N. Bogdanov (1871), the flying squirrel occurs in the northwestern part of the former Kazan Province (in spruce forests). In about 1820 the flying squirrel occurred on the watershed of the Ashita and Kazanka rivers (former Kazan County). Bogdanov did not find it in the oak forests of the former Laishevo County. According to I. Bashkirov and N. Grigor'ev ("A Survey of Commerical Hunting in Tataria" (Ocherk okhotnich'ego promysla Tatarii).—Rabota Volzhsko-Kamskoi promyslennoi stantsii, Issue I, 1931, p. 35), the flying squirrel occurs rarely in the Lubyanskii Forest (on the boundary between the Mamydyshskii Canton and the Vote Region [Udmurt SSR]), in the forests of the Krasnoborskoye Forestry (Yelabuga Canton), and in the Zelenodolskii Forest near Kazan. Farther northeast it occurs in the Vyatka and Perm
298 forests (M. N. Bogdanov, "Studies on Russian Hunting" (Etyudy russkoi okhoty), in "Okhota i konnozavodstvo", No. 5-6, 1874, p. 119).

According to A.N. Korsakov (in litt., 1933), it occurs in the Vote Region in forests of the Mozhga District. It occurs rarely in the Mozhga Forestry near the village Oshmest', 16-18 km southwest of Syuginskaya railway station, at 56°15' N and 22° E (near Pulkovo). In the Zyryan Region (Komi) in the former Ust-Sysolsk County of the Vologda Province it occurs rarely in the upper reaches of the Vychegda. In the Udorskii District (Komi Region), in the northern part of the former Vologda Province and in the southern part of the former Arkhangelsk Province it occurs rarely in the upper reaches of the Mezen (62°30' and 64°40' N and 45°30' and 50°35' E).

According to L. P. Sabaneev (1874), it occurs rarely on the Urals in the Goroblagodatskii and Bogoslovskii districts. It is common in the Yekaterinburg [Sverdlovsk] birch forests. According to K. K. Flerov (1933), it occurs rarely in the northern Urals along the Lyapin Basin, sometimes as far as the Synya river. It is common along the Sosva. It was found by N. M. Dukel'skaya (1928) on the southern Urals in the Ilmenskii Range. E. E. Eversman (1850) recorded it from pine and spruce forests of the Urals, especially from the central and northern Urals. It is found at 52° N in forests between the Sakmara and Ik rivers, but not south of this latitude. On 14 December 1880, N. A. Zarudnyi (1897) found a flying squirrel in the lower reaches of the Sakmara, in the Karaevskaya Grove. The forests along the lower reaches of the Sakmara are separated from the forests in the middle and upper reaches of the river by a large area without forests.

According to N. A. Zarudnyi the flying squirrel was common in these districts.

According to I. Ya. Slovtsov (1892) the flying squirrel is common in the Tumen district in the Trans-Ural forests of western Siberia. It is numerous in the Turinsk District and rare in the Pelym District. It is very rare near Berezov. It occurs on the Konda, occurs regularly in the Surgut Territory and rarely in the northwestern part of the Yalutorovsk District and the western part of the Kurgan District. It is found regularly along the Urals. S. M. Chugunov (1915) recorded one specimen caught in the Surgut taiga in the Yugan Valley. In I. Shukhov's opinion (1928), the flying squirrel is distributed throughout the marshy taiga of the former Tara District, where it occurs in small numbers.

According to A. M. Belyaev (1934), the flying squirrel is found in "ribbon" pine forests of the former Semipalatinsk Region and in birch groves on the right-bank region of the former Pavlodar County in southwest Siberia. M. K. Serebrennikov (1929) recorded it from forests 200 km north of Pavlodar. G. K. Holtzmeyer (1935) reports that the flying squirrel is common in pine forests of the former Semipalatinsk Region, e. g., in the Srostinsk Pine Forest.

Finch obtained the flying squirrel on the Altai near the village Altaiskaya (A. M. Nikol'skii, 1884). It was later found by N. F. Kashchenko (1902) in mountains on the right bank of the Chulyshman, on the eastern coast of the Teletskoe Lake, and also near the village Chergi (N. F. Kashchenko, 1899). Specimens from the upper reaches of the Bukhtarma, from near Barnaul are in the ZMAN collection.

299 In my collection is a pelt obtained by Razorenova in the valley of the Katun. V. Selevin (in litt., 1935) informed me that the flying squirrel occurs in the Kolbinskie Mountains. Farther east it occurs in the Sayan Mountains (G. Radde, 1862), and in the former Minusinsk District (on the Tukeek-Kem, Suturzhu-Karasuk—B. S. Vinogradov, 1927). It also occurs in the mountains near the village Oznachennoe and Monok in the former Minusinsk County (N. Dukel'skii, 1930), in the Minusinsk and Khakassian districts (M. D. Zverev, 1930), in the former Krasnoyarsk and Achinsk counties (I. N. Shukhov, 1925). V. V. Gubar obtained numerous specimens in the Troitsk District (northern part of the former Biisk County of the Tomsk Province). Two specimens were caught by the expedition of V. P. Anikin (1902) in the Narym Territory. G. E. Iohansen (1923) reported it

from near Tomsk and forests along the Chulym river (near the village Novokuskovo, Tranikovo Locality). Northeast of these districts the flying squirrel occurs in forests along the Yenisei and Tunguska rivers. According to N.P. Naumov (1934), it is common along the Lower Tunguska. According to A. Middendorf (1861), it reaches 68°N. along the Yenisei. Tell (Nordenskjöld's "Expedition to the Estuary of the Yenisei" (Ekspeditsiya k ust'yam Eniseya, 1880, p. 178) saw many pelts in Turukhansk and Verkhneibatsk. E.O. Yakovlev (1930) reports that the flying squirrel occurs in some parts of the forest tundra in the Turukhansk Territory, e.g., in Lake Chirinda Region.

According to S.P. Naumov (1931), the animal was observed near Yanovstan (66°N). Records from the forest tundra (near 67°N) are doubtful. East of the Yenisei it reaches about 69° N near the Norilskie Lakes (R. Maak, 1886). In the Olenek Valley it occurs as far as 68°N. It is common along the Vilyui except in its upper reaches. It is widely distributed in the Lena Basin (I. Polyakov, 1873) and on the Aldan (ZMAN collection), is common near Yakutsk (S.I. Ognev's collection), and occurs in the Verkhoyansk District (A. Bunge, 1887). It certainly occurs along the Indigirka. In the Kolyma Valley it was recorded from Verkhe-Kolymsk and Sredne-Kolymsk (J.A. Allen, 1903; S.I. Ognev, 1926). According to N.P. Sokol'nikov (1927), it occurs in deciduous forests 50-60 km from the village Markovo (along the Anadyr river). These forests follow the river for 100 km to its upper reaches. The flying squirrel also occurs in forests along the Maina river from its left tributaries, i.e., the Algans. L.A. Portenkov (1932-1934) obtained a good series near the village Yeropal on the Chukot Peninsula. It does not occur in Kamchatka. It was found along the shore of the Sea of Okhotsk, near Okhotsk, Ola and Ayan. It occurs in forests in Gizhiga and is common on the Shantarskie Islands. According to L.v. Schrenck it is found in the valley of the Amur, near Nikolaevsk-on-Amur, from where I examined specimens, and also in the Amur Estuary, at the coast of the Tatar Gulf, in the De-Kastri Region, as far as Bai-Khadzhi in the south. It is widely distributed on Sakhalin where it is sometimes common. In my collection is a good series from Argi-Pagi (north Sakhalin). The expedition of V.S. Stakhanov and K.A. Vorob'ev (1932) caught a large series in the Amur Basin, from the Khungari river, Lake Bolon'-Odzhala, Khor river, a tributary of the Ussuri, De-Kastri Gulf, and Taba Bay in the Tatar Gulf. It was caught in Olga (Maksimovich — ZMAN collection), and also near Petropavlovskoye Lake, 50 km from Khabarovsk (ZMAN collection). According to G.N. Gassovskii (1927) 300 the flying squirrel occurs farther east in the Gilyui-Ol'doi Mountain Region, the Teokit and Koval basins, on the northern slope of the Tukuringra Range, along the Bezymennaya river, and ravines along the right tributaries of the Ol'doi river. In the country of the Orochis A.A. Emel'yanov (1927) found flying squirrels in Bouchi and Kopi.

According to Radde (1862), the flying squirrel occurs rarely in the Burein Mountains and also in the middle reaches of the Onon river, along the Shilka and Argun rivers, and on the southern part of the Yablonovoi Range (Sokhondo Mountain, and at the source of the Ingoda, near Akshinsk and Mogotui).

According to N.F. Kashtchenko (1910) it occurs in Transbaikalia in the former Verkhneudinsk [Ulan-Ude] and Troitskosavsk [Kyakhta] counties, in birch forests of the Aga Valley (N.F. Kashtchenko, 1913). B.A. Kuznetsov

(1929) observed the flying squirrel in the Yablonovoi Range taiga and its foothills, near the village Kyker, along the Shantelka, Shantera, Shanterkeken rivers and other tributaries of the Nercha river; near village Zyuzel'kan, on the Udinskii Range, etc. According to S. Sofronov (1926), it is common near Chita. It is not rare in the Barguzin forests (G. P. Doppelmaier, 1926) on the Koty Peninsula in Baikal (S. I. Ognev, 1929). In the ZMAN collection are specimens from the Hentey Mountains (Baik-Gol Area) and from the Sungur Ravine (northwestern Mongolia).

It was recorded from the Ussuri Territory by N. M. Przheval'skii (1870).

In the ZMAN collection are specimens from the following places: Poset Bay (collected by M. Yankovskii); the upper sources of the Kulume (collected by V. K. Arsen'ev); vicinity of Cossack village Razdel'naya (collected by A. N. Formozov). In my collection is a specimen obtained near Okeanskaya railway station (collected by E. M. Vermel'). According to Sowerby (1923), it occurs in the western part of the Shansi Province and in Chihli [Hopei] northeast of Peking). It also occurs in Korea and Japan (on Honshu and Hokkaido).

It is not exactly known how far south the flying squirrel occurs in China.

Map V shows the distribution of the various subspecies of the flying squirrel.

MODE OF LIFE. In the central section of the European part of the U. S. S. R. the flying squirrel occurs mainly in mixed forests, especially in coniferous forests mixed with birch and aspen.

A. N. Formozov (in litt., 1936) found flying squirrels in the Gorki Region (former Kostroma Province and also former Makar'ev and Semenov counties of the Nizhni Novgorod Province) in humid spruce or spruce-fir forests mixed with birch, alder and aspen.

In the southern Trans-Urals flying squirrels are common in birch groves.

Along the Irtysh they occur in the region of "ribbon" pine forests together with Sciurus vulgaris exalbidus Pallas. According to I. Ya. Slovtsov (1892), flying squirrels occur in mixed forests in the Tobolsk Territory where they find pine trees with holes made by the black woodpecker. The flying squirrel apparently does not avoid "Urmans", i. e., the marshy taiga of the northern Tobolsk Territory.

301 According to B. A. Kuznetsov (1929), the favorite habitats of the flying squirrel in Transbaikalia are high forests with many old, hollow trees. The animal is especially fond of thickets along banks of brooks and streams. Near the village Kyker the flying squirrel most frequently occurs in the taiga along the Shamtelka, Shantera, Shanterkeken rivers and other tributaries of the Nercha. In the vicinity of the village Zyuzil'kan it mainly inhabits old birch-larch forests in the valleys of the Zyul'za and Zyulzil'tan rivers. On the Udin Range the flying squirrel occurs at present only in small parts of the taiga with pine and larch forests which still exist in some inaccessible localities.

K. A. Vorob'ev (in litt., 1933) describes the habitats of the flying squirrel in the Amur Region: "The flying squirrel lives in forests of willow, aspen, hornbeam, Juglans mandshurica, black birch, spruce and fir. We also found it on slopes of hills covered with mixed forests of cedar, fir, spruce, black birch, hornbeam and yew shrubs (e. g., along the Khungari river). It occurs frequently in forests with numerous old, hollow pine trees in which it builds its nest."

In the mountains of Siberia, e.g., on the Altai, the flying squirrel is found in typical habitats. It was found by A.N. Kolosov in a birch forest at an altitude of 500 m near the Teletsk Lake. In summer 1935 flying squirrels were caught on the Altai by Professor S.S. Turov's expedition, in a large forest at an altitude of about 1000 m.

In extreme northeastern Siberia, e.g., in the Anadyr Territory, the flying squirrel occurs in larch forests along the Anadyr.

We know very little of its habits. It begins its activity 1/2 -1 hour after sunset. Its characteristic voice can then be heard from hollows, or from trees. The voice of the flying squirrel resembles the chirping of bats like Nyctalus noctula. A. Rekst told me that he heard the voice of the flying squirrel regularly on Sakhalin. The best indication of its presence on Sakhalin are the large, yellowish pellets usually found in heaps near the base of trees or in the forks of large branches.

One rarely sees tracks of flying squirrels in the snow. They resemble tracks of squirrels but are much smaller and the leaps are very short. The tracks are rarely longer than 10-15 m, beginning at the base of one tree and ending at the base of another (A.N. Formozov, in litt., 1936).

The most peculiar habit of the flying squirrel is its ability to fly by means of its parachuting membrane. According to V.V. Raevskii and L.G. Kaplanov (1929), the flying squirrel is capable of leaping from the top of a tree and gliding for 40 m. The glide descends, and the animal lands by clinging to the bark, halfway up the tree. The flying squirrel glides slowly in a straight line.

302 During flight the animal spreads its forelegs laterally. The spurs of the forefeet facilitate the stretching of the parachuting membranes. The hind legs are kept close together along the tail. The silhouette of the gliding animal is thus triangular.

The animal leaps from the top of a tree and glides down. However, it occasionally changes its direction and glides upwards before landing on a tree. This ascent may be caused by an air current against the spread parachuting membrane.

The glide of the flying squirrel is noiseless. The flying squirrel appears unexpectedly in the twilight in a glade among the trees or in a clearing. V.V. Raevskii (1929) reports that in the Tugoles Forestry (former Moscow Province) flying squirrels are often seen in spring during courtship of the woodcock. The hunters occasionally shoot flying squirrels, mistaking them for woodcocks.

Our knowledge of the daily life of the flying squirrel is very incomplete.

Most authors state that the flying squirrel is crepuscular and nocturnal, hiding during the day. V.V. Gubar' (1930) writes that bright daylight is disagreeable to it.

Exceptionally the flying squirrel is active during the day. A. Cherkasov (1867) writes "In Transbaikalia, I often saw flying squirrels unexpectedly in the forest in broad daylight. While I was riding slowly along a path... something would suddenly fly from a tree, swiftly flit near the head of the horse and disappear among the branches of trees... Taking it for a hazel hen I would dismount, take my gun and hide. I would then see a flying squirrel sitting on a branch, looking down with its large, black eyes... the flying squirrels are bold, agile animals. They are easily shot as they are not afraid of man."

A.N. Formozov (in litt., 1936) writes that he killed a flying squirrel at noon in the middle of November. The animal was returning to a hollow in a tree which had been felled in order to examine the hollow.

The flying squirrel generally chooses hollows in trees as shelters for its nest. In the central part of the European U.S.S.R. flying squirrels usually occupy hollows in old aspens. In the Gorki Region A.N. Formozov (in litt., 1936) found nests in holes of the spotted and black woodpecker in alders, birch and aspen. These nests were 3-10 m above the ground. One tree would sometimes contain several hollows, each occupied by a nest. The nests were built of lichen (Usnea barbata and Usnea longissima).

303 In birch groves in Baraba the flying squirrel usually inhabits hollows in birch. In forests of the Tobolsk Territory I. Ya. Slovtsov (1892) found nests in pine trees. These hollows had been made by black woodpeckers. According to B.A. Kuznetsov (1929), flying squirrels make their nests in Transbaikalia in hollows in old birches or larches, sometimes in abandoned nests of woodpeckers (Dendrocopus major and Picus martius).

V.V. Gubar' (1930) gives the following data for the Novosibirsk flying squirrel: "Flying squirrels are usually found in hollows in high aspens 3-4 m above the ground. Only once did I find an inhabited hollow very low, at a height of 1.5 m. It is simple to determine whether a hollow is inhabited. When the trunk is tapped with an ax, the flying squirrel comes half out of the hole or jumps out completely. Confused by the light, its movements become very slow. The frightened animal climbs about 1 m along the trunk and then stops, clinging to the tree and spreading its parachuting membrane. After about a minute the animal slowly climbs higher. Due to its protective color it is almost invisible on the bark. At the top of the tree the animal settles on a branch, rolls up into a ball and suddenly jumps into the air. The parachute spreads and the small glider gradually descends to a nearby tree. Flying squirrels never land on a branch. They always land on the trunk

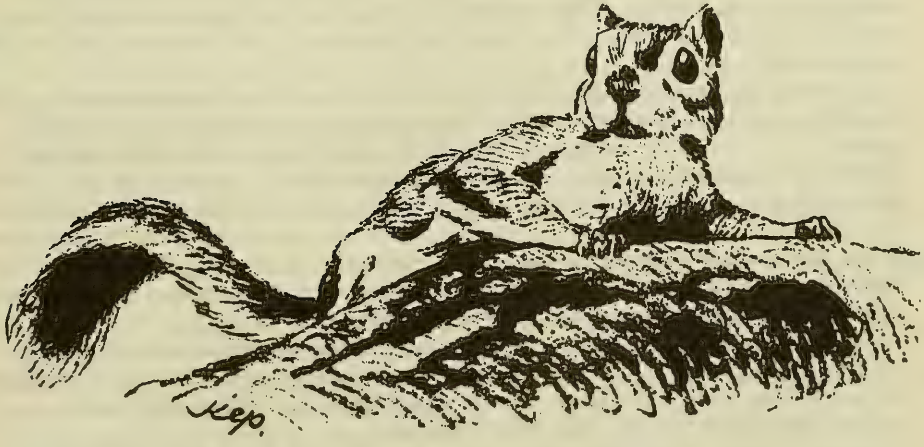

FIGURE 163. Flying squirrel on a bough

Drawing by K. K. Flerov

about 1-2 m above the ground. They do not land in the middle of the trunk but at the side, i.e., tangentially, apparently in order to absorb the shock. In other cases, the flying squirrel crouches at the top of the tree as if preparing for flight, and then stays motionless, ignoring stones and sticks thrown at it."

304 Flying squirrels generally build their nests in hollows, but sometimes also in starling boxes. This was observed by G.E. Johansen (1923) during the expedition to the Chulym, by V.V. Gubar' (1930) in the Ust'-Chemsk Legostaevskii District (former Novosibirsk District) and by M.D. Sverevoi (see Gubar's work), who found a nest in a starling box in a pine forest near the Berek Station of the Altai Railway.

A.M. Kolosov informed me that he found a nest in the hollow of a birch which had been previously inhabited by wild bees. A. Cherkasov (1867) observed in Transbaikalia that flying squirrels usually descend to defecate in one place near the roots of the tree. Such "latrines" are a reliable indication of a colony of flying squirrels. A. Cherkasov writes: "If one finds such a heap of feces one has only to tap the tree with a stick and the squirrel will invariably jump out of a hollow. Flying squirrels also often inhabit abandoned nests of birds or squirrels.

K.A. Vorob'ev (in litt., 1933) studied the structure of nests of flying squirrels in the Ussuri Territory and Amur Region.

He writes: "The height above the ground at which the squirrels make their nests varies considerably. All nests which we found in the Amur Territory in summer 1932 were in hollows in willow, aspen or hornbeam, 5-9 m above the ground. Most of these hollows had apparently been made by the black woodpecker*. We felled some trees with nests in order to examine the material of which the nests were made. They were always built of dry grass, small roots and moss. There were sometimes also a few feathers of hazel hen, nutcracker or other birds.

"On 14 August 1932 we found a nest near the Khungara river at the edge of water in a wood of willow, hornbeam and many shrubs. The nest was in a dry willow 5 m above the ground. The opening was 6 cm wide. The nest was at the bottom of the hollow, 63 cm below the entrance. It consisted of moss, rotten wood and bird feathers. No remains of food were found in it."

We have no detailed information on the food of the flying squirrel. V.V. Raevskii and L.G. Kaplanov (1929) thought that it fed mainly on nuts of spruce. V.V. Gubar' writes: "We dissected the stomach of all flying squirrels obtained in order to determine their food. Almost all the animals dissected were caught in September. Their stomach contents indicated that they fed almost exclusively on pines. This was assumed from the presence in the stomach of a green bolus with a strong pine smell. The food was so finely chewed that it was impossible to determine its origin. It apparently consisted of young shoots and green pine cones."

A.N. Formozov (in litt. 1936) found food reserves consisting of alder
305 catkins and small twigs in nests and hollows of flying squirrels in the Gorki Region. The weight of these stores was 30-400 g. There were also occasional birch catkins and spruce cones.

According to I. Ya. Slovtsov (1892), the food of the flying squirrel mainly consists of birch buds. The hunters think that it also eats the pulp of pine cones and frozen mushrooms. I. Ya. Slovtsov writes: "I fed flying squirrels in captivity with all three foods mentioned. First of all they ate fresh young birch buds. Then they gnawed the mushrooms. Only when there was no other food, did they accept pine cones. The completely ignored pine nuts.

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* Cf. the observations of I. Ya. Slovtsov (1892) in the Tobol'sk Territory.

"The flying squirrel is rather voracious. One pair consumed 1.5 lbs of buds daily."

A. Cherkasov (1867) writes: "The flying squirrel feeds mainly on birch and aspen catkins. Hunters think that it also eats small birds which it catches at night on trees and in nests. They also stated that it attacks even squirrels, suffocating them in their nests."

V.I. Iokhel'son (1898) reports that Kolyma hunters also think that the flying squirrel attacks squirrels in their nests. The flying squirrel spreads its parachuting membrane during the fight. The squirrel bites through the parachuting membrane. However, the flying squirrel allegedly always wins. It is, however, incapable of using its damaged parachute for some time. G.K. Gol'tsmaier (1935) hear similar stories from hunters during his studies of Sciurus vulgaris exalbidus in the Srostinsk Pine Forest (south of the former Semipalatinsk Region).

These reports are doubtful. However the fact that such beliefs are held by hunters in different and far removed districts makes it necessary to consider them seriously and to verify them.

Our knowledge of the reproduction of the flying squirrel is very incomplete. Stoll' (1906) writes that the Baltic flying squirrel has two litters per year, one in late February and the second in June. Each litter consists of 2 or 3 young. P. Wesmuth (1908) on the other hand, claims that the Baltic flying squirrel has only one litter in June, that its gestation is 4 weeks, and that the litter consists of 2 or 3 young.

A. Cherkasov (1867) writes that the Transbaikal flying squirrel has only one estrus, in spring, and that it has 1 or 2 young.

On 21 July 1929 B.A. Kuznetsov found 4 young and a suckling female in a hollow of an old larch on the bank of the Shanter in Transbaikalia. The young were already able to run on the trees, jumping from one branch to another.

A.P. Razorenova found a young flying squirrel on 10 July 1930 on the bank of the Katuni on the Altai. On 18 August 1932, A. Larovskii found a very young specimen near the Khungari river. The fur on the tail was little developed and much shorter than in adults.

N.P. Sokol'nikov (1927) writes that in the Anadyr Territory the flying squirrel has only one litter a year (late April-early May) and no more than 3 young.

As we have not enough material we cannot determine exactly the molting
306 periods of the flying squirrel. The sequence of the autumn molt of Pteromys seems to be the opposite of that of the squirrel. In the flying squirrel the molt starts at the head, occiput and shoulders, continuing towards the tail. The tail of the flying squirrel acquires its luxuriant, long winter fur already in late summer.

We also know little of its enemies.

V.V. Gubar' (1930) reports that in western Siberia the flying squirrel is preyed upon by cats. It is apparently also preyed upon by ermines, martens and owls.

Flying squirrels are not hunted much. According to B. A. Kuznetsov (1932), the number of pelts dressed in the U.S.S.R. is very small. This is however true only of the U.S.S.R. as a whole. In some districts hunting of flying squirrels is intensive, e.g., in some parts of Transbaikalia (B.A. Kuznetsov, 1929).

According to K.A. Vorob'ev (in litt., 1933), hunting of the flying squirrel is increasing in the Amur territory. It was hunted in the Amur Territory only accidentally in the past. According to figures of furs collected in 1928-1929, 16,184 flying squirrels were obtained in the Far Eastern Territory.

Subspecies of the flying squirrel

350. **Pteromys volans volans Linn. (1758). Common flying squirrel**

1758. (Sciurus) volans Linnaeus, C., Systema Naturae, editio X, p. 64 (nec Mus volans Linnaeus, C., l. c., p. 63); Pallas P., Novae Species Quadrupedum e Glirium Ordine, 1778, pp. 355-369; Pallas P. S., Zoographia Rosso-Asiatica, 1811, 190-191 (partim!).

1808. Pteromys russicus Tiedemann, Fried. Zoologie zu seinen Vorlesungen entworfen. Zoologie des Menschen und der Säugethiere, I, S. 451 (Russland).

1822. Pteromys sibiricus Desmarest A. G., Mammalogie ou description des espèces de Mammifères, II, p. 342.

1829. Pteromys borealis Dvigubskii I., Opyt estestvennoi istorii vsekh zhivotnikh Rossiiskoi imperii (A Natural History of the Animals of the Russian Empire), p. 32.

1843. Pteromys vulgaris Wagner A., in: Schrebers Ch. Säugethiere, Supplementum III, S. 228 (instead of volans!).

1851. Sciuropterus vulgaris Simashko Yu., Russkaya fauna (Russian Fauna, II), pp. 597-599.

1857. Pteromys volans Blasius J. F., Naturgeschichte der Säugethiere Deutschland, S. 26; Bogdanov M. N., Etyudy russkoi okhoty. Okhotnich' i promyslovye zveri i ptitsy Evropeiskoi Rossii (Studies on Russian Hunting. Game and Commercial Mammals and Birds of European Russia) "Okhota i konnozavodstvo", No. 5-6, 1874, p. 119.

1874. Sciuropterus sibiricus, Brehm A., Zhizn' zhivotnykh. II (Life of Animals, II) p. 64.

1898-1899. Sciuropterus volans Trouessart E. L., Catalogus Mammalium, I, pp. 401-402.

1903. Sciuropterus russicus Allen J., Bull. Amer. Mus. Natur. History, XIX, p. 132 (partim!); Trouessart E. L., Faune des Mammifères d'Europe, 1910, p. 116; Miller G. S., Catalogue of the Mammals of Western Europe, 1912, pp. 941-946; Ognev S. I., Mlekopitayushchie Moskovskoi gubernii (Mammals of the Moscow Province), 1913, pp. 281-282.

TYPE LOCALITY AND DEPOSITION. The type locality is not known exactly. The holotype was lost. Linnaeus states "In borealibus Europae, Asiae et Americae".

In G. S. Miller's opinion, use of the phrase "in borealibus Europae" means that Linnaeus was describing a flying squirrel from Sweden. However, G. S. Miller names the European flying squirrel Sciuropterus
307 russicus (see above), accepting the name proposed by Tiedemann. In Tiedemann's opinion, the type locality, "Russia" is "too vague". This opinion is shared by Miller. If we accept Linnaeus' name for the European flying squirrel, central Sweden should be considered as type locality of Pteromys volans volans.

MATERIAL EXAMINED: 44 pelts, most of them with skulls.

DIAGNOSIS. General color of winter fur ash-gray with a slight straw tinge (darker than drab-gray, Ridgway, 1912), more intense than light mouse-gray but lighter than mouse-gray. Tail dorsally dark grayish brown in the middle and pale straw-colored laterally. Tail black-gray with an irregular lighter grayish pattern ventrally. Summer fur on back blackish gray (dark mouse-gray) with straw-gray mottling (between drab and mouse-gray). Tail of summer fur smoke-gray dorsally. Middle and apical parts of tail with a strong admixture of hair with broad black tips, giving a grayish tinge.

Length of skull in full-grown specimens 38.2-41.3 mm (M. 39.92 mm); condylobasal length 34.9-37.8 mm (M. 36.4 mm); zygomatic width 22.8-25.2 mm (M. 24.02 mm); length of nasals 11.9-13 mm (M. 12.33 mm); length of upper molar row 7.1-7.7 mm (M. 7.28 mm).

Length of body 149-172 mm (M. 164.7 mm); tail without terminal hair 98-130 mm (M. 113.1 mm); hind feet without claws 32-39 mm (M. 35.9 mm).

ADDITIONAL DESCRIPTION. Color of winter fur based on specimens from Vladimir, Kostroma and Nizhni Novgorod. General color of back ash-gray with a slight straw tinge (darker than drab-gray, but lighter than mouse-gray). Head, entire back and large parts of parachuting membranes of the same color as the back. The color is formed from the following elements: 1) broad, gray roots of hair (deep neutral gray); 2) wide light straw-gray subapical parts of hair; 3) black hair tips of almost all hair on the back. There is also long guard hair with broad, black tips. Broad dark roots of hair clearly show on the margins of the outstretched parachute. The color of the margins of the parachute is therefore blackish slate-gray.

Middle of dorsal part of tail dark grayish brown (between hair-brown and mouse-gray). Terminal part of tail with a strong admixture of blackish hair. Tail dorsally pale straw-gray at the sides. The color of the hairs on the dorsal side of the tail is as follows: 1) roots gray (mouse-gray); 2) pale straw-gray subapical belts; 3) black tips. Many hairs with broad black tips everywhere give a dark color to the dorsal side. Ventral side of tail black-gray with an irregular grayish pattern consisting of more deeply colored stripes from the sides to the middle.

Underparts white with a well marked yellowish tinge especially on the belly. Roots of hair ash-gray.

308 SUMMER FUR. Back blackish gray (dark mouse-gray) with straw-gray mottling (between drab and mouse-gray). Color of hairs as follows: 1) roots broadly black-gray; 2) a narrow gray band; 3) a straw-gray subapical band; 4) hair tips blackish.

Top of head like that of back. Parachutes black-gray, grayish only at the margins. Dorsal side of tail smoke-gray at the sides (between pale mouse-gray and palid mouse-gray). Middle and apical parts of tail consisting of hair with gray (neutral gray) roots, whitish gray subapical parts and broad black tips, which give a generally dark color. Color of ventral side of tail whitish gray with an irregular black pattern.

Dorsal side of feet black-gray mixed with whitish gray hair. Ventral side yellowish white. Outer posterior margin of feet with very long hair.

Belly dirty whitish with a slight straw-yellow tinge.

Roots of hair on belly pale gray.

Hair of lower part of back 17-18 mm long in winter fur, in summer fur 12-14 mm.

Summer fur thinner and less luxuriant than winter fur.

SYSTEMATIC NOTES. Until recently it was assumed that the whole European U.S.S.R. is inhabited by only one subspecies of the flying squirrel. However, a series obtained by S.U. Stroganov in the Western Region (former Ostashkov County, and from the Velikie Luki District) showed that this region is inhabited by a well characterized straw-rust colored form (P. v. ognevi Strogan.). These color characters should not be considered as accidental. Near the eastern boundary of the range of the nominate subspecies occur specimens which are transitional to P. v.

gubari. Specimens of this subspecies already occur in the birch groves of Bashkiria (southern Trans-Urals).

GEOGRAPHICAL DISTRIBUTION. The common flying squirrel is widely distributed throughout the European U.S.S.R. The northern and southern boundaries of its range and details of its distribution are discussed in the general survey. P. v. ognevi Strogan. is distributed from the line Rzhev - Staritsa - Torzhok - Vyshni Volochek and farther west (apparently as far as the Baltic). The exact boundaries of the range of the common and western flying squirrels are not known. The common flying squirrel is replaced by P. v. gubari Ogn. in Bashkiria (southern Trans-Urals).

351. Pteromys volans ognevi Strogan. (1936). Western flying squirrel or Ognev's flying squirrel

1936. Pteromys ognevi Stroganov S. U., Novye dannye po sistematike nekotorykh gryzunov (New Data on the Systematics of Some Rodents). Sbornik Nauchno-Issledovatel'skogo instituta zoologii Moskovskogo gosudarstvennogo universiteta No. 3, pp. 111-114.

1936. Pteromys volans ognevi Stroganov S. U., Fauna mlekopitayushchikh Valdaiskoi vozvyshennosti (The Mammal Fauna of the Valdai Hills), Zoologicheskii zhurnal, XV (3): 539. Moscow 1936.

TYPE LOCALITY AND DEPOSITION. Lake Peno in the Western Region (sources of the Volga, former Ostashkovskii County of the Tver Province). Type No. M.4158 female adult, 10 Dec. 1933, collected by S. U. Stroganov. S. I. Ognev's collection.

MATERIAL EXAMINED: 10 specimens.

DIAGNOSIS. Winter fur on back generally ash-gray with well marked straw-rust tinge which is most saturated on shoulders, neck and cheeks. Tail straw-yellow-gray with well marked black hair tips in the middle, dorsally and ventrally, which give a dark color to the whole length of the middle of the tail. Sides of tail lighter colored, without black hair tips and with a well marked yellow-straw-rust tone.

MEASUREMENTS. Length of skull 36.7-39 mm; condylobasal length 34.7-36.7 mm; zygomatic width 23.9-24.5 mm; length of nasals 12.4-12.9 mm; length of upper molar row 6.6-7.5 mm. Length of body and head 160-163 mm; tail without terminal hair 95-120 mm; hind feet without claws 34-37 mm.

ADDITIONAL DESCRIPTION. Winter fur. Straw-rust tinge, (close to avellaneous (Ridgway, 1912. pl. XL)) clearly marked on general gray color of back. Straw-rust tinge most saturated on shoulders, neck and cheeks. It is weak only on the dorsal side of the parachutes and on the dorsal side of fore- and hind legs. Margins of parachutes dark because of the dark gray roots of the hair. Ears gray. Tip of ears with a poorly developed whitish fringe which forms small tufts on the posterior side of the ears.

All underparts whitish gray with a slight rust-straw tinge which becomes more intense in the inguinal region and on the ventral side of the parachutes.

Tail yellowish straw-rust colored (near avellaneous, pl. XL, with pinkish buff tinge, pl. XXIX).

Dorsal and ventral side of tail darker due to a considerable admixture of black caused by the broad black roots of the hairs.

The summer fur resembles that of P. volans volans in its general dark color but differs in the pale straw-rust tone of the hair tips on the back. The tail also differs from that of the typical form in its more straw-rust color.

SYSTEMATIC NOTES. This subspecies differs clearly from the nominate form. Pteromys v. ognevi is characterized mainly by the well marked straw-rust tinge of both winter and summer fur, and the straw-rust colored tail. Dorsal and ventral side of tail with well developed black hair tips.

P. v. ognevi resembles P. v. betulinus much more closely than the common flying squirrel. P. v. ognevi differs from the West Siberian flying squirrel in its dirtier gray color of winter fur. Its belly is not white as in betulinus but darkened by a gray-straw-rust tinge.

Summer fur of P. v. ognevi very similar to that of P. v. betulinus

310 P. v. ognevi differs from P. v. athene as follows: 1) winter fur not so light; 2) light hair tips on back of summer fur much less developed; in P. v. athene these hair tips are light straw-yellow.

GEOGRAPHICAL DISTRIBUTION. Not known exactly. The eastern boundary of this form apparently runs along the line Rzhev-Staritsa - Torzhok - Vyshni Volochek - Novgorod. This subspecies apparently occurs in the former Pskov Volochek Province and the Baltic Region. More material should be examined in order to decide this.

352. Pteromys volans gubari Ogn. (1934). West Siberian flying squirrel

1902. Sciuropterus volans Anikin V. P., Otchet o komandirovke v Narymskii krai (Report on an Expedition to the Narym Territory), 1902, p. 67.

1923. Sciuropterus russicus Johansen G. E., Po chulymu (Along the Chulyma), Izvestiya Tomskogo gosudarstvennogo universiteta, p. 63; Gubar' V. V., Zametki po biologii letyagi (Notes on the Biology of the Flying Squirrel), Izvestiya Sibirskoi kraevoi stantsii zashchity rastenii, 1, 1930, pp. 78-79.

1934. Pteromys volans gubari Ognev S. I., Obzor letyag (Pteromys), Vodyashchikhsya v SSSR (A Survey of Flying Squirrels (Pteromys) of the U. S. S. R.), Byulleten' Moskovskogo obshchestva ispytatelei prirody, otdel Biologii X, III (2): 304-305.

TYPE LOCALITY AND DEPOSITION. West Siberia, Troitsk District (northern part of the former Biisk County), No. M.4036 female, Dec. 1930, V. V. Gubar', type in S. I. Ognev's collection.

MATERIAL EXAMINED: Holotype and 12 paratypes.

DIAGNOSIS. Winter fur differs from that of the European flying squirrel in its lighter silver-gray color on the back with a slight straw tinge (which may be absent), and by the dull whitish gray tail. In Pteromys volans volans the middle of the tail on the dorsal side is dark gray-brown and the lateral parts straw-gray. Summer fur differs from that of the common flying squirrel in its very pale dirty gray color with a straw tinge.

Length of skull 39.2-41 mm (M. 40.2 mm); condylobasal length 35.7-36.9 mm (M. 36.5 mm); zygomatic width 23.1-24.5 mm (M. 23.8 mm); length of nasals 12.1-13.1 mm (M. 12.5 mm); length of upper molar row 7-7.5 mm (M. 7.2 mm).

Length of body 135.5-171 mm (M. 155.3 mm); tail 109-140 mm) (M. 119.3 mm); hind feet 33-39.3 mm (M. 35.3 mm).

ADDITIONAL DESCRIPTION. Color much lighter than that of the common flying squirrel, more silvery, with a less marked straw tinge (color of back pale mouse-gray, Ridgway, 1912, pl. LI).

Hair on back 15-17 mm long. Color as follows: 1) roots deep gray (neutral gray), broad; 2) tips of hairs short, very pale gray-straw-white. Head, parachuting membranes and back of the same color.

Dorsal side of tail dull whitish gray (between pale mouse-gray and pale drab-gray) with a brownish black tinge caused by the dark tips of some hairs.

Belly white, without any yellow shade. Roots of hair on belly pale gray.

311 Summer fur of adults pale dirty gray on back with a straw tinge (between drab gray, light drab and pale mouse gray). Top of head and occiput whitish gray. Anterior part of muzzle, cheeks and area behind the ears with an admixture of white. Straw tones of back best developed in lower part. Parachuting membranes with more intensely colored deep mouse-gray hair roots. This ground color appears lighter because of the silver-straw hair tips.

Dorsal side of tail whitish, with a slight straw tinge in one specimen. Middle of ventral side of tail with a marked gray tinge on the whitish ground color.

Feet whitish. Ventral side of feet white, sometimes with a slight straw tinge. Hair roots pale gray.

Color of young duller and more gray. Tail with brown-gray hair tips through which the whitish roots of the hairs show.

SYSTEMATIC NOTES. P. v. gubari and P. v. volans show marked differences.

The West Siberian flying squirrel differs from P. v. betulinus Serebr. in its winter fur. The gray color of P. v. betulinus is much purer and its tail is whitish gray without any straw tinge.

The winter fur of the West Siberian flying squirrel differs from that of P. v. incanus as follows: 1) hair shorter and less luxuriant; 2) tail without straw-rust tones. Its summer fur differs from that of betulinus as follows: 1) pale yellow color of back much less well developed; 2) tail whitish without straw-rust tinge. Fur of young P. v. gubari also grayer than that of betulinus.

GEOGRAPHICAL DISTRIBUTION. A large area in western Siberia from the birch groves of the Shelyabinsk District, to the Baraba Region, Novosibirsk, Barnaul and Biisk in the east. Its northern boundary is not known exactly. Specimens from the Narym District and from the Chulyma river possibly belong to this subspecies.

It is not known which subspecies occurs in the north of the Tobol'sk Territory.

A pelt from the Vershinskie area near the Kazyma river is in the ZMAN collection (collected by M.I. Shukhov on 1 April 1914). Color of this specimen rather intense, very similar to that of Altai specimens.

353. Pteromys volans betulinus Serebr. (1929). Semipalatinsk flying squirrel

1929. Pteromys volans betulinus Serebrennikov M. K., Ein Flatterhömchen aus dem Kirgisengebiet, Ztschr. f. Säugetierk. Bd. 4, S. 142-143. Taf. XIII.

312 1934. Pteromys volans Belyaev A. M., Spisok gryzunov Kazakhstana (A List of Rodents of Kazakhstan), Trudy zoologicheskogo instituta, 2 (1) : 32 ("Ribbon" Pine Forests of the Semipalatinsk Province, Birch Groves in the Former Pavlodar County).

1934. Pteromys volans belulinus Ognev S. I., Obzor letyag, vodyashchikhsya v SSSR (A Survey of Flying Squirrels in the U. S. S. R.), Byulleten' Obshchestva ispytatelei prirody, otdel Biologii, 10, 3 (2) : 305-306.

TYPE LOCALITY AND DEPOSITION. Tosta, Pavlodar County, Semipalatinsk Province (200 km north of Pavlodar). Type No. 18013, male, 18 Aug. 1927, collected by A. Dobrinin. ZMAN collection.

MATERIAL EXAMINED: Holotype and 22 paratypes.

DIAGNOSIS. Winter fur on back light silver-gray with a clear straw-yellow tinge (between drab gray and pale mouse-gray). Dorsal side of tail with a yellow-straw-rust tinge (more yellowish than avellaneous, Ridgway, 1912). Summer fur with well marked dull straw-yellow tinge. Dorsal side of tail straw-yellow with a slight rust tinge*.

Length of skull 39.2-41.3 mm (M. 40.4 mm); condylobasal length 35-37.3 mm (M. 36.58 mm); zygomatic width 22.9-25.4 mm (M. 24.07 mm); length of nasals 12-13.1 mm (M. 12.5 mm); length of upper molar row 7-7.3 mm (M. 7.19 mm).

Length of body 116-172 mm (M. 157.1 mm); tail without terminal hair 98-119 mm (M. 113 mm) (122 according to M. K. Serebrennikov); hind feet without claws 34-39 mm (M. 35.8 mm).

ADDITIONAL DESCRIPTION. Winter fur. Back light silver-gray with a well marked yellow-straw tinge (between drab-gray and pale mouse-gray).

Color very similar to that of P. v. athene Thos. (see below) but more yellowish. Fur of P. v. athene from Shantar and Yakut more pinkish. Top of head and back of the same color.

Hair on parachute long, more silvery, with less marked straw tinge. Dorsal side of tail straw-yellow rust colored (between pinkish buff and avellaneous).

The black-brown tips of hairs contrast clearly with the ground color, especially in the terminal third on the dorsal side. These hair tips give a grayish tinge to the ground color.

A broad medium whitish gray stripe on the ventral side of the tail, lateral parts straw-gray.

Dorsal side of feet with mixed gray and whitish silver hair. Toes with short straw-white fur. Soles, especially the inner parts, with dense whitish hair.

Belly white. Sides of belly in some specimens with a slight pale straw tone.

313 In adults, summer fur on back with marked straw-yellow tone caused by hair tips of this color. Color of summer specimens of P. v. betulinus very similar to that of P. v. athene from Sakhalin. General color of summer fur of P. v. betulinus lighter and more yellow. Dorsal side of tail pale straw-yellow.

Summer fur of young duller. Yellowish tone on top of head and parachuting membranes paler than in adults, without reddish and rust tones.

Yellowish tone of tips of hair on back absent in some specimens and color of back closely resembling mouse-gray with a slight gray-straw tinge.

SYSTEMATIC NOTES. The ranges of P. v. betulinus and P. v. gubari are adjacent. The color of P. v. betulinus closely resembles that of P. v. athene. The winter fur of the Semipalatinsk flying squirrel differs from that of athene as follows: 1) more yellowish shade mixed with the silver-gray ground color, as against the pinkish straw shade of the winter fur of some specimens of P. v. athene; 2) fur of back of P. v. betulinus not so luxuriant and soft as in P. v. athene; 3) tail duller and more yellow.

Summer fur of P. v. betulinus similar to that of P. v. athene, but paler and duller.

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* This diagnosis does not agree with that given by M. K. Serebrennikov (see below).

M.K. Serebrennikov (1929) certainly described a partly albinistic specimen of P. v. betulinus.

The summer fur of all forms of Pteromys is darker than the winter fur as a rule. In the holotype of P. v. betulinus (which has a complete summer fur) the dark gray pigment is very weak, but the straw-rust-yellow color is partly preserved (especially on the back and on the tip of the tail). The gray color is better preserved on the dorsal surface of the parachuting membranes and on the haunches and shanks of the hind legs. The feet are white. The whole underparts are also white, without any gray hair roots.

This distribution of colors results in a very light whitish gray color of the back, with a straw-rust-yellow tinge on the back.

The fact that M.K. Serebrennikov examined three very pale specimens is no proof that there is a whitish geographical form. It should be stressed that these three specimens were all caught in August 1927 in the same locality. There seems no doubt that they belong to the same family of partly albinistic specimens. M.K. Serebrennikov states (1929) that P. v. betulinus has a larger skull and body than the European and Sakhalin forms. Our data (see measurements in Tables 33 and 34) do not support this conclusion.

GEOGRAPHICAL DISTRIBUTION. Birch groves of the forest steppe north and west of Pavlodar.

The same subspecies occurs in ribbon pine forests in the south of the former Semipalatinsk Region, e.g., in the Srostinsk Pine Forest (former Zmeinogorsk County). It is not known how far east this pale form occurs. 314 It occupies the southern outskirts of the range of Pteromys in western Siberia. North of Barnaul and Biisk it is replaced by a grayer and very pale form, P. v. gubari.

354. Pteromys volans turovi Ogn. (1929). Central Siberian flying squirrel

1858. Pteromys volans Schrenck L., Reisen und Forschungen im Amur-Lande, I, S. 116-118; Maak R., Puteshestvie na Amure (A Journey Along the Amur), Sankt Petersburg, 1859, Obzor zhivotnykh (A Survey of Animals), pp. 103-104, Radde G., Reisen im Süden von Ost-Sibirien, 1862, S. 131-132.

1922. Sciuropterus volans var. sibiricus Dybowski B., Arch. Tow. Nauk. Lwowie, III, p. 8 (Dauria, Amur).

1926. Sciuropterus russicus Doppel'maier G. G., Sobolinyi promysel na poberezh'e Baikala (The Sable Trade on the Shore of Lake Baikal), p. 38.

1929. Pteromys volans turovi Ognev S. J., Über einige Nagetiere Ostsibiriens, Zoologischer Anzeiger, Bd. 83, H. 1/4, S. 75; Ognev S. I., Mlekopitayushchie Shantarskikh ostrovov (Mammals of the Shantar Islands), Izvestiya Tikhookeanskoi nauchno-promyslovoi stantsii, 2 (5): 1929, p. 1.

TYPE LOCALITY AND DEPOSITION. Bol'shie Koty (near Lake Baikal). Type No. M. 1241, 6 Oct. 1923, collected by Professor S. S. Turov. S. I. Ognev's collection.

MATERIAL EXAMINED. Holotype, 19 specimens from Transbaikalia and 33 specimens from various localities in eastern Siberia.

DIAGNOSIS. Winter fur dark, dirty straw-gray with marked black mottling. Ground color of dorsal side of tail dull straw-gray or dull gray (without any straw tinge) with well marked black-brown hair tips giving a dark color to the tail.

Back of summer specimens gray-straw-rust-colored. Rust tones sometimes very weak. This color appears darker because of dark gray hair roots on the back. Color of dorsal side of tail from very dull straw-yellow-gray (more yellow and duller than drab, Ridgway, 1912) almost without black hair tips, to yellow-rust-red (near cinnamon, Ridgway, 1912) with a black-brown tinge caused by such hair tips.

Length of skull 38-41 mm (M. 40.3 mm); condylobasal length 31.2-37.6 mm (M. 35.8 mm); zygomatic width 22.2-24.7 mm (M. 23.68 mm); length of nasals 12-13 mm (M. 12.39 mm); length of upper tooth row 7-7.7 mm (M. 7.20 mm). Length of body 170-172 mm; tail 98-110 mm (M. 103.5 mm); hind paws 30-36.2 mm (M. 33.0 mm).

ADDITIONAL DESCRIPTION. Winter fur generally of dark, dirty grayish straw color with marked black-gray mottling caused by black guard hair and the black-gray tips of many hairs on the back; general color close to mouse-gray with a drab tinge.

Top of head usually lighter with a straw tinge. Small patches of whitish fur behind the ears.

Dorsal side of tail dull straw-gray or dull gray with a marked dark shade caused by many black or black-brown hair tips. Roots of hair on
315 tail deep dark gray (deep neutral gray), with straw-gray subapical parts and black-brown tips. Ground color of ventral side of tail pale straw-gray covered with a black or black-brown pattern caused by dark hair tips.

Feet gray with marked silvery mottling caused by admixture of whitish hair.

In summer fur of fully grown and old specimens, ground color of back gray-rust-straw. Rust tones developed to a variable degree. The general color consists of the following elements: 1) broad dark slate-gray (deep neutral gray) hair roots; 2) broad rust-straw colored hair tips, (between wood-brown and cinnamon) which are sometimes duller, straw-gray (between drab and buff-brown). Top of head of about the same color as the back, but usually more intense.

Color of tail between dull straw-gray-yellow (more yellow and duller than drab) to yellow-rust-red (close to cinnamon). Black-brown hair tips cause a dark, well marked tinge in the ground color. Ventral side of tail often ash-gray, lateral parts rust colored with a black or black-brown tinge, while the middle of the tail remains gray.

Dorsal side of feet straw-gray. Hair on tips of toes longer and straw-white. Soles dirty white, rust-reddish laterally. Two color types were found in series of young summer specimens. In the first, most common type, the back is dull straw-gray with strong dark-blue gray admixture caused by the color of the roots of the hair.

Color of tail dull straw-gray (between light drab and light mouse-gray) with a blackish brown tinge especially in the terminal third of the tail. Ventral side of tail dull straw-gray with a black tinge.

Dorsal side of feet brownish straw-gray with a light silvery tinge.

Dorsal side of parachutes black-brown. Hair tips with a slight straw tinge especially along the margin of the parachutes.

Fur on the ventral side dirty whitish, with a slight rust tinge laterally.

Young of the second color type have reddish rust hair tips and short, soft fur, which is also well marked on the tail.

Reddish rust tones mainly on underparts and flanks, contrasting with the white background.

316 Color of very young specimens of the same year (specimens from the Teletsk Lake on the Altai, 31 August 1932) as follows: Back with a marked straw-gray tinge (drab). Dorsal side of parachutes with soft blackish brown fur. Hair of tail very short, 10-12 mm long with well

marked black hair tips, so that the tail appears completely black, especially in its terminal half.

Straw-gray tone (drab) of hair roots clearly marked in basal part of tail. Ventral side of tail almost black, with straw-gray tone only at the base.

Belly whitish. Hair roots gray. Sides of belly with a slight rust tinge.

Feet with a mixture of gray and straw colored hair. Tips of toes pale straw colored. Soles whitish. Inner side of feet with black margins.

SYSTEMATIC NOTES. The range of the central Siberian flying squirrel extends from the Altai to the Okhotsk Coast and the Amur. It differs clearly from the European flying squirrel in its dark, dirty straw-gray color (with a black tinge) in winter. Summer fur with reddish rust tones on the back and especially on the tail.

These colors are typical of old summer specimens of the central Siberian flying squirrel but are not present in the European subspecies. The range of the Sakhalin flying squirrel (P. v. athene) is adjacent to that of P. v. turovi. P. v. athene is easily distinguished from P. v. turovi as follows: 1) lighter tone of winter fur; 2) typical rust-yellow tinge of summer fur; 3) absence of reddish rust tone in summer fur, which appears in fully grown P. v. turovi.

Specimens from the following localities are identical with typical P. v. turovi: upper reaches of the Bukhtarma (2 specimens, ZMAN collection); vicinity of Barnaul (Gebler, ZMAN collection); Altai (without exact indication of locality); specimens from Professor E. Eversman's collection (ZMAN collection). These specimens differ little from typical turovi in their lighter, grayer color. Their resemblance to P. v. turovi is so great however, that they are considered to belong to this geographical form.

GEOGRAPHICAL DISTRIBUTION. P. v. turovi occurs on the Altai, in the Sayans, northern Mongolia (near Mondy, the ravine of the Sungur in northwestern Mongolia), on the Hentey, in Transbaikalia, and in the Amur Region to the middle reaches of the Amur (Goryun river, Lake Bolon'-Odzhal, Khor river).

355. Pteromys volans athene Thos. (1907). Sakhalin flying squirrel

1861. Pteromys volans Schmidt Fr., Bemerkungen über die Säugethierfauna Süd-Sachaliens, etc., Mélang. Biol., IV, p. 107; Nikol'skii A. M., Ostrov Sakhalin i ego fauna pozvonochnykh zhivotnykh (The Vertebrate Fauna of Sakhalin), 1889, pp. 122-123; Suprunenko, Pozvonochnye Sakhalina (The Vertebrates of Sakhalin), 1890, p. 39.

317 1907. Sciuropterus russicus athene Thomas O., The Duke of Bedford's Zoolog. Explor. in East Asia, IV, Proceed. Zoolog. Society, London, pp. 409-410.

1929. Pteromys volans aluco Ognev S. J., Über einige Nagetiere Ostsibiriens, Zoologisch. Anz. Bd. 83, H. 1/4, S. 71-76; Ognev S. I., Mlekopitayushchie Shantarskikh ostrovov (Mammals of the Shantar Islands), Izvestiya tikhookeanskoi nauchno-Promyslovoi stantsii, 2 (6):11-14. Vladivostok 1929.

TYPE LOCALITY AND DEPOSITION. Korsakov Station on Sakhalin. Holotype (a young August specimen) in the British Museum.

MATERIAL EXAMINED: 25 specimens.

DIAGNOSIS. Winter fur with a light silver-gray tone on the back with a marked straw tinge. Color intermediate between drab gray and pale mouse-gray (Ridgway, 1912).

Dorsal side of tail with a marked straw-rust tinge. Summer fur with well developed straw-yellow color. Dorsal side of tail straw-rust colored.

Length of skull 39.3-42.2 mm (M. 40.77 mm); condylobasal length 36.2-38.2 mm (M. 37.07 mm); zygomatic width 23-25.2 mm (M. 23.74 mm); length of nasals 12.3-13.7 mm (M. 12.74 mm); length of upper tooth row 7-7.3 mm (M. 7.2 mm).

ADDITIONAL DESCRIPTION. Winter fur light silver-gray with a clear straw tinge (between drab gray and pale mouse-gray) on top of head and back. Long hair on dorsal side of parachuting membrane more silver-gray, with a less marked straw tinge. Dorsal side of tail with well marked straw-rust (avellaneous) tone sometimes with a grayish tinge caused by black-brown tips of hairs. Median stripe on the ventral side of tail gray, straw-rust-colored laterally.

Color of hair of the median stripe on the ventral side of tail as follows: 1) dull gray roots; 2) broad whitish bands; 3) black-brown tips.

Dorsal side of feet with gray and silver-white hair. Soles with dense white hair.

Belly white. Sides with a straw-rust tone. Roots of hair lead-gray.

Summer fur with well marked straw-yellow color. Color of hair tips intermediate between avellaneous-buff-brown and clay color. Top of head lighter and grayer. Back sometimes with a rust tinge.

Color of hair on back as follows: 1) intense gray (deep neutral gray) or even darker roots; 2) straw-yellow subapical bands sometimes with a rust tinge. Tips of some hair brownish black. Some long, black guard hairs are present among the other hairs.

318 Dorsal side of tail yellow-straw-rust (between avellaneous, wood-brown and buff-brown). In some specimens, dorsal side of tail darker because of grayish black hair tips, especially on terminal part of tail. Ventral side of tail duller, whitish straw-yellow with well developed black hair tips which form an irregular pattern in the middle and terminal parts.

Dorsal side of feet with gray and straw colored hair. Soles with dense whitish hair.

Color of underparts variable. In some specimens it is white with a straw-rust tinge at the sides. In other specimens nearly the whole belly has a straw-rust tinge (between pinkish buff and cinnamon-buff),

Color of young in summer generally dull. Anterior part of back and parachutes without reddish and rust color. General color dull, buff-brown, darkened by long guard hairs with black or gray-black tips.

Dorsal side of tail dull yellowish gray (between drab and buff-brown) with well marked gray-black hair tips, especially in distal third of tail.

Belly, especially at the sides, dirty white with rust-ocher shades.

SYSTEMATIC NOTES. The winter fur differs from that of P. v. volans L. as follows: 1) lighter straw shade on back; 2) marked straw-rust tones on dorsal side of tail.

The color of the tail of six Sakhalin specimens in the ZMAN collection shows considerable variation. In two specimens the yellow-straw tinge of the tail is very weak and is replaced by gray tones.

The differences between P. v. athene, P. v. ognevi and P. v. turovi have been described above. The color of the winter fur of P. v. athene closely resembles that of P. v. betulinus.

In conclusion, the confused taxonomy of the Japanese flying squirrels will be discussed. Most authors who have dealt with this question had only limited material, which has produced confusion. For example, Nogamichi Kuroda (On three new Mammals from Japan, Journ. of Mammalogy, Vol. 2, No. 4, 1921, pp. 208-209) described a new subspecies, Sciuropterus russicus orii, from six specimens from Hokkaido (Yezo). According to him the skull of this subspecies is larger than that of P. v. athene and its zygomatic arches are wider. The only data on P. v. athene at Kuroda's disposal were measurements of the single young specimen described by Thomas.

Kuroda gives the following measurements for Sciuropterus russicus orii: length of skull 39.5 mm; basal length 30.5 mm; 319 zygomatic width 24 mm; postorbital width 9 mm; interorbital width 7.5 mm; width of rostrum in front of nasals 6.5 mm; length of nasals 13 mm; diastema 8 mm; length of bullae 10.5 mm; length of upper tooth row 6.5 mm.

These measurements clearly show that the skull of Sciuropterus orii is identical with that of P. v. athene. (see measurements in Table 35).

Kuroda writes that the color of S. r. orii is much lighter than that of P. v. athene. However, Kuroda used winter specimens while P. v. athene was described from a summer specimen. The description of winter fur of S. russicus orii by Kuroda agrees well with that of P. v. athene. There is a winter specimen from Hokkaido in the ZMAN collection, which has the same color as athene. Its skull is also identical with that of P. v. athene. S. russicus orii is therefore synonymous with P. v. athene.

O. Thomas attempted to clarify the systematics of Japanese flying squirrels (Proceedings Zoological Society of London, 1905, pp. 344-345).

After examination of material from the southern and central parts of Hondo and the paratype of Pteromys momonga Temm. (supplied by the museum of Leyden) Thomas came to the conclusion that P. momonga, which is a small form, was described from one of the southern islands of Japan ("will prove to be an inhabitant of one of the southern islands").

O. Thomas made a new subspecies, Sciuropterus momonga amygdali for specimens from Hondo. These conclusions of O. Thomas are doubtful, not being based on exact data. Temminck (Fauna Japonica, 1850, p. 49) does not indicate the exact type locality of his Pteromys (Sciuropterus) momonga. He writes: "On trouve cette espèce, due aux soins de M. Bürger, dans les forêts de l'intérieur, ou elle vit dans les troncs des arbres et se nourrit de noyaux et de semences".

Finally, the status of S. momonga as a separate species is doubtful. Hondo Island is probably inhabited by a subspecies of P. volans.

GEOGRAPHICAL DISTRIBUTION. Sakhalin, Hokkaido, lower reaches and estuary of the Amur. The specimen from Ayan (collected by Voznesenskii, ZMAN collection) certainly belongs to this form. It is difficult to decide how far west this form occurs. However, it certainly occurs near Lake Petropavlovskii, 183 km from Khabarovsk. Flying squirrels from St. Ol'ga Bay are transitional to the Ussuri form in color.

356. Pteromys volans incanus Miller (1918). Yakut flying squirrel

1873. Pteromys volans Polyakov I., Geograficheskoe rasprostranenie zhivotnykh v yugo-vostochnoi chasti Lenskogo basseina (Geographical Distribution of Animals in the Southeastern Part of the Lena Basin), Zapiski Geograficheskogo obshchestva, III, pp. 34-35; Maak R., Vilyuiskii okrug (The Vilyui District) II, Sankt Petersburg, 1856, pp. 142-143.

1898. Flying squirrels. Iokhel'son V. I., Ocherk zvero-promyshlennosti v Kolymskom okruge (A Survey of the Animal Trade in the Kolyma District), Sankt Petersburg, p. 67.

1903. Sciuropterus russicus Allen J. A., Report on the Mammals, collect. in Northeast Siberia, Bull. Amer. Mus. Nat. History, Vol. XIX, pp. 132-134.

1918. Pteromys volans incanus Miller G. S., A New Flying Squirrel from Eastern Asia. Proceed. Biol. Society of Washington, Vol. 31, pp. 3, 4.

1926. Pteromys volans incanus Ognev S. I., Mlekopitayushchie Severo-Vostochnoi Sibiri (Mammals of Northeastern Sibiria), pp. 89-93 (partim!).

TYPE LOCALITY AND DEPOSITION. Vicinity of Verkhnekolymsk. Type No. 200613, female, ad., 24 April 1915. Collected by Copley Amori. Deposited in the U. S. A. National Museum.

MATERIAL EXAMINED: 21 specimens.

DIAGNOSIS. Winter fur sharply different from that of P. volans L. in the following characters: 1) lighter silver-straw-gray tone of back (between pale drab-gray and pallid mouse-gray); 2) straw color of tail; 3) long, luxuriant, silky fur, especially on the tail.

Summer fur with a straw tone on a dull background on the back and with a straw-rust shade on the tail.

Length of skull 40.1-41.6 mm (M. 41.01 mm); condylobasal length 37.1-38.7 mm (M. 37.83 mm); zygomatic width 24.6-25.6 mm (M. 25.03 mm); length of nasals 11.1-13.6 mm (M. 12.73 mm); length of upper tooth row 7.2-7.7 mm (M. 7.4 mm).

Length of body 161-180 mm; tail 100-141 mm; hind feet 31-38 mm.

DESCRIPTION. Winter fur resembling that of P. v. gubari but with a more marked straw tone (between pale drab-gray and pallid mouse-gray). Top of head, back and dorsal side of parachuting membrane of the same color.

Hair on back very long, up to 24-26 mm. Color as follows: 1) roots broad, gray (between neutral gray and deep neutral gray); 2) tips pale whitish gray with a slight straw tinge. Some hair with blackish tips producing a grayish tinge.

Tail very luxuriant. Color of dorsal side pale straw-gray (drab and light-drab), darkened by blackish tips of hairs.

Straw (drab) shade on tail more marked than in P. v. gubari. Ventral side of tail whitish straw-gray or ash-gray with an irregular blackish brown pattern in the middle and terminal parts of tail caused by broad black or black-brown hair tips.

Dorsal side of feet silver-ash-white. Soles with unusually dense and long white hair.

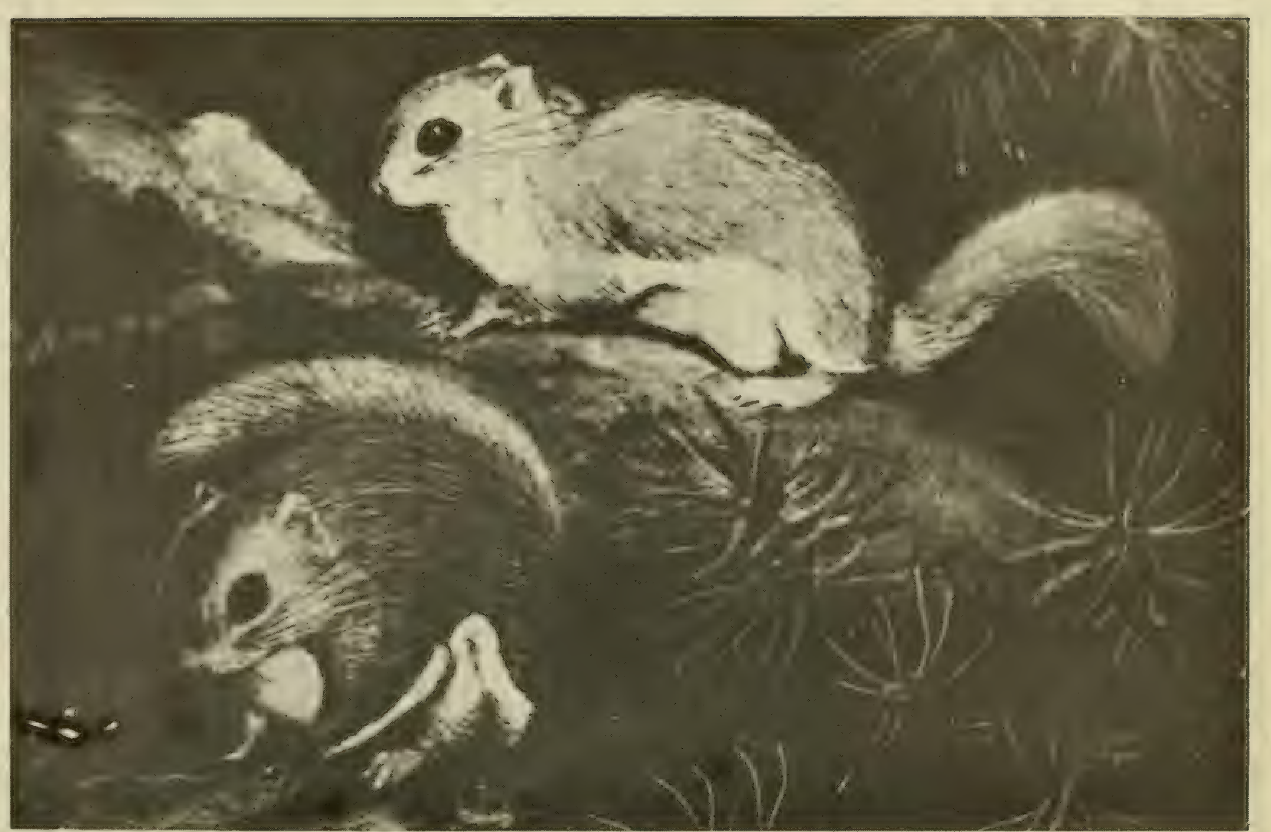
Underparts white with a slight yellowish tinge. Roots of hair of underparts gray.

SUMMER FUR. Underparts mouse-gray with a pale straw-gray (drab) tinge. Top of head, forehead and occiput like underparts. More marked straw tones on neck. Sides of neck and region behind the ears with two white stripes the color of which passes gradually into the color of the cheeks.

321 Hair on back up to 20 mm long. Color as follows: 1) roots broad deep gray (between deep mouse-gray and deep neutral gray); 2) well marked, wide, whitish straw-gray, subapical bands; 3) tips of most hairs blackish gray. Tips of some hairs straw colored (drab). Hair on the sides of the back and on the dorsal side of the parachuting membranes darker and their roots more intensely gray (dark neutral gray).

Light colored bands on the hair of the parachuting membranes little developed. The color of the parachuting membrane is therefore very dark.

PLATE V



Upper figure - Anadyr flying squirrel (Pteromys volans anadyrensis Ogn.); lower figure — Yakut flying squirrel (Pteromys v. incanus Miller) (Beginning of autumn molt)

Drawing by V. A. Vatagin

Throat, chest and belly white with a slight yellowish tinge.

Hair on tail up to 33 mm long, with mixed whitish, straw-rust and blackish tones.

Feet with whitish and brownish black hair.

SYSTEMATIC NOTES. The winter fur of this form resembles that of P. gubari but differs from it as follows: 1) more marked straw tone on back; color of hair on back of P. v. gubari more silvery; 2) tail with a marked straw tone, which is absent in specimens of gubari examined; 3) fur much longer and more luxuriant.

The summer fur of P. v. incanus differs from that of gubari as follows: 1) straw tones on back less developed; 2) fur duller and longer.

I examined a large series of P. v. incanus from various localities in Yakutia. Their color was rather uniform. However, the extent of the straw tinge on back and tail varied.

The color of specimens from the Anadyr Territory and the Chukchi Peninsula, differs from that of P. v. incanus in some respects.

GEOGRAPHICAL DISTRIBUTION. The subspecies occurs in the valley of the Kolyma as far as Nizhne-Kolymsk (I have specimens from the locality in my collection), in the Verkhoyansk Territory, the Lena and Aldan valleys. Specimens from the lower Tunguska also belong to this subspecies. The western boundary of the range of P. v. incanus is not clear. It is not known which subspecies occurs in the northern Yenisei Territory. In the south, the range of P. v. incanus is adjacent to that of P. v. turovi, in the southeast to that of P. v. athene, in the northeast to that of P. v. anadyrensis. The exact boundaries of the ranges of these subspecies will have to be determined in the future.

357. Pteromys volans anadyrensis subsp. nov. Anadyr flying squirrel

1926. Pteromys volans incanus Ognev S. I., Mlekopitayushchie severo-vostochnoi Sibiri (Mammals of Northeastern Siberia), pp. 89-93 (partim!); Ognev S. I., Obzor letyag, vodyashchikhsya v SSSR (A Survey of the Flying Squirrels of the U. S. S. R.), Byulleten' Moskovskogo obshchestva ispytatelei prirody, otdel Biologii, 10, 3 (2):308-309. 1934 (partim!).

322 1927. Pteromys volans incanus Sokol'nikov N. P., Okhotnich'i i promyslovye zveri Anadyrskogo kraya (Game and Commercial Animals of the Anadyr Territory), Byulleten' Moskovskogo obshchestva ispytatelei prirody, otdel Biologii, Vol. XXXVI, p. 136.

TYPE LOCALITY AND DEPOSITION. Eropol Village, Anadyr Territory. Type: No. 798, male, February 1932, L. A. Portenko's collection. Type in the collection of the All Union Arctic Institute.

MATERIAL EXAMINED: holotype and 13 specimens.

DIAGNOSIS. Winter fur differs from that of P. volans volans as follows: 1) lighter and purer bluish gray color of back (between pale neutral gray and dull gray, plate LIII, Ridgway, 1912); 2) usually luxuriant and silky winter fur; 3) hair of tail very long; 4) skull larger and molar row longer than in P. v. volans. P. v. anadyrensis differs from P. v. incanus as follows: purer bluish silver-gray color of back; straw tinge on back and tail of most specimens absent.

Length of skull 41.2-42.2 mm; condylobasal length 38-38.3 mm; zygomatic width 25.3-25.7 mm; length of nasals 13-14 mm; length of upper tooth row 7.5-8 mm.

Length of body 170-207 mm; tail 95-110 mm; hind feet 35-37 mm.

ADDITIONAL DESCRIPTION. In winter fur, back pure bluish gray (between pale neutral gray and dull gray). Specimens collected by L. A. Portenko's expedition to the Chukchi Peninsula (on behalf of the All-Union Arctic Institute) were of this color. In specimens collected by N. P. Sokol'nikov, back duller, of a more silvery shade with a light straw tinge. Color of hairs on back as follows: 1) roots deep gray, near neutral gray 2) subapical parts pale whitish gray; 3) tips of hair dark gray. Top of head and upper part of back with hair of the color described.

Tail very luxuriant, dull gray with a light straw-white tinge, without the straw-rust tone which is typical of P. v. incanus.

Tail generally dull straw-gray. This color is caused by hair with pale whitish gray roots and appears dark because of blackish brown hair, or hair with broad blackish brown tips.

Ventral side of tail whitish gray, darkened by many blackish hair tips.

Belly white, without any yellow tones. Roots of hair on belly gray (neutral gray).

SYSTEMATIC NOTES. The description of P. v. incanus by G.S. Miller (1918) agrees well with the color characters observed. G.S. Miller states that the color of the hair on the back of P. v. incanus is pale whitish gray with a buff tinge: "On the upper parts and sides this is overlaid by a whitish gray with a barely perceptible tinge of buff, the two colors blending into a general effect that is near the pallid mouse-gray of Ridgway...

"Tail of the same color as back but with a buff tinge at the sides and at
323 the tip above..."

The Anadyr flying squirrel thus differs from the P. v. incanus in the absence of the buff tinge on the back and in the darker color of the upper part of the body.

P. v. incanus was described from a specimen from Verkhnekolymsk. It is intermediate between the more buffy and rust tailed P. v. incanus and the pale silvery P. v. anadyrensis.

GEOGRAPHICAL DISTRIBUTION. Larch forests along the Anadyr and Maine rivers in the Anadyr Territory.

358. Pteromys volans arsenjevi Ogn. (1934). Ussuri flying squirrel

1870. Pteromys volans Przheval'skii N. M., Puteshestvie v Ussuriiskom krae (A Journey to the Ussuri Territory), Sankt Peterburg, pp. 254-255.

1923. Sciuropterus russicus Sowerby A. de C., The Naturalist in Manchuria, Vol. II-III, pp. 144-145.

1934. Pteromys volans arsenjevi Ognev S. I., Obzor letyag, vodyashchikhsya v SSSR (A Survey of the Flying Squirrels in the U. S. S. R.). Byulleten' Moskovskogo obschestva ispytatelei prirody, otdel Biologii, 10, 3(4): 30.

TYPE LOCALITY AND DEPOSITION. Sources of Kulume river, Ussuri Territory. Type collected on 16 November 1929 by V. K. Arsen'ev.

MATERIAL EXAMINED: holotype and 5 paratypes.

DIAGNOSIS. Winter fur dirty buff-gray. Yellowish brown shades well marked on midline of back, clearly contrasting with the ground color. Back mouse-gray. Middle of back hair-brown with marked buff-brown and olive-brown tinges.

Ground color of tail yellowish buff-brown (between buff-brown and clay color). In summer fur, color of back gray-rust-buff. Tail rust-red (cinnamon). Summer fur of young yellowish brown (between buff-brown and sayal brown). Tail of a purer yellow tinge.

Length of skull (from one old specimen) 38.3 mm; condylobasal length 36 mm; length of nasals 12.1; length of upper tooth row 7.2 mm.

ADDITIONAL DESCRIPTION. The characteristic color of the back is described above. Yellowish brown (buff-brown) tones well marked on top of head. Parachutes dorsally gray, with a weaker buff tinge than the back.

Ventral side of tail with a marked grayish tinge darkened by black hair tips.

Color of young summer specimens from the vicinity of the Razdol' Station of the Ussuri Railway yellowish brown-buff (between buff-brown and sayal brown). Tail of a purer yellowish shade than in adults.

SYSTEMATIC NOTES. The winter fur of the Ussuri flying squirrel has a very typical color which resembles that of P. büchneri Satun. from Han-Su, in the presence of yellowish brown shades in its summer fur.

324 I previously considered the Maritime Territory and Amur flying squirrels as P. v. aluco Thos. (Sciuropterus aluco). This subspecies was described from a specimen caught in the vicinity of Kaloguai, 55 miles northeast of Seoul (Korea) on 25 November 1906. (Duke of Bedford's Zoological Exploration in Eastern Asia. V. Second list of Mammals from Korea, Proceed. Zoolog. Society, London, 1907, 464-465). The holotype is in the British Museum (No. 76318).

After examination and comparison of the characters of the Korean, Maritime Territory and Amur flying squirrels I came to the conclusion that they do not belong to the same subspecies. Thomas states that the Korean flying squirrel, P. v. aluco Thos., is small. The measurements of the female are as follows: length of body 157 mm; tail 149 mm; hind feet 35 mm; ear 19.5 mm.

Length of skull 39 mm; basal length 29.5 mm; maximal width of skull (apparently measured at the level of the zygomatic arches) 23 mm; nasals 12.2 × 5; interorbital space 7.5 mm; width of braincase 17 mm; length of palate 16.2 mm; length of palatine foramina 5.5 mm; length of bulae osseae 10.2 mm; length of row of teeth (without p^3) 6.5 mm; greatest width of m^1 1.8 mm.

In Thomas's opinion P. v. aluco is smaller than P. v. volans, but this statement seems of little value as only one specimen was examined.

A comparison of the Maritime Territory and Korean flying squirrels can not be based on skull structure or measurements of skull and body, owing to lack of material. However, an analysis of the color characters gives some results.

Thomas describes the color of the Korean flying squirrel from one specimen collected in late November as follows: "General color pale buff-drab, not so strong as in momonga nor of such a clear gray as in russicus. Upper surface of hands and feet gray, the light hairs on the toes cream colour, more extended proximally than in the allied forms. Tail pinkish buff (very pale yellowish with a light reddish tinge), the intermixed black hairs of the upper layer unusually few in number and therefore not hiding the buff."

Thomas does not indicate whether the holotype was in summer or winter fur. However, the description of the color and the date of collection indicate clearly that the specimen was in winter fur.

The Korean flying squirrel differs from the Ussuri subspecies in its very light tail, the color of which is pale yellowish buff-drab, almost without black hair.

A.S. Lukashkin sent me an interesting male specimen from the Dzhandungol, a tributary of the Khaidarkhe (Argun'), on the western slopes of the Great Khingan (28 December 1934). The specimen has a light colored winter fur with buff tones. It is much lighter than P. v. turovi and differs clearly from P. v. arsenjevi in its small size. In some respects it resembles P. v. aluco Thos. in its color.

325 Length of body 162 mm; tail (without terminal hair) 103 mm; hind feet 30 mm; ear 16 mm.

Length of skull 38.2 mm; condylobasal length 34.7 mm; zygomatic width 24.2 mm; width of skull at level of auditory openings 20.2 mm. The specimen was killed near a hollow in a larch tree.

GEOGRAPHICAL DISTRIBUTION. Not clear. The subspecies apparently occurs in the Ussuri and Sungazi basins, and on the Posyet Peninsula. I examined specimens from the following localities: 1) No. 3796, February 1883, Posyet Peninsula. N. Yankovskii, ZMAN collection; 2) 16 November 1929, upper sources of the Kulume, Ussuri Territory, V.K. Arsen'ev ZMAN collection; 3) 14 November 1929, same locality; 4) No. 20645, 14 November 1929, same locality; 5) vicinity of the Razdol' Station of the Ussuri Railroad, 1928, collected by A.N. Formozov; this summer specimen was found, according to its label, in February; the date is apparently wrong; 6) No. M. 1697, female, September 1926, Okeanskaya Station, Maritime Territory, E.M. Vermel' (S.I. Ognev's collection).

Flying squirrels from the Chinese provinces Shansi (western part) and Hopei (northeast of Peiping) mentioned by A. de Sowerby (The Naturalist in Manchuria, II—III, 1923, pp. 144-145), possibly belong to this subspecies.

Family SCIURIDAE

1821. Sciuridae Gray, I. London Medic. Repos., XV, 304, Apr. 1.

Body slender or thickset, adapted to arboreal or terrestrial life.

Tail always without horny scales, densely covered with hair, often dorsoventrally depressed. Tail of arboreal forms with long hair.

Structure of skull varying, but never adapted to underground life. Infraorbital canal long and compressed. Infraorbital foramen very small. Frontals with well developed postorbital processes. Bony palate wide. p $\frac{3,4}{4}$; m $\frac{1,2,3}{1,2,3}$. Molars with short crowns and long roots. Testes inside scrotum. Os penis present.

GEOGRAPHICAL DISTRIBUTION. Western and eastern hemispheres except for the extreme north and south. Not present in Madagascar, New Guinea, Australia or the Pacific islands.

The family includes the following subfamilies*:

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* R. Pocock, The Classification of the Sciuridae, Proceed. Zoolog. Soc. London, 1923, part I, pp. 209-246.

326 1) Sciurinae. The subfamily includes the genus Sciurus, subgenus Tenes (=Oreosciurus) and the American subgenera Parasciurus, Araeosciurus, Neosciurus, Hesperosciurus, Otosciurus. Distribution: Palearctic, Nearctic and Neotropical regions.

2) Tamiasciurinae with the genus Tamiasciurus - Nearctic Region.

3) Funambulinae with the genera: Funambulus, Tamiodes, Ratufa, Protoxerus, Aetosciurus, Funisciurus, Paraxerus, Heliosciurus, and possibly also Myosciurus. Distribution: Ethiopian and Oriental Region.

4) Callosciurinae with the genera: Callosciurus, Menetes, Tomeutes, Rhinosciurus, Lariscus, Dremomys, Tamiops, Nannosciurus. Distribution: Oriental Region from India to China and Borneo.

5) Xerinae with the genera: Atlantoxerus, Xerus, Euxerus, Geosciurus. Distribution: Africa from Morocco to the Cape Province.

6) Spermophilopsinae with the genus Spermophilopsis. Distribution: Transcaspian Desert, Iran and some parts of Turkestan.

7) Marmotinae with the genera: Marmota, Marmotops, Otospermophilus, Callospermophilus, Citellus (Subgenera: Urocitellus, Colobotis); genera: Ammospermophilus, Cynomys (subgenera: Cynomys s. str. and Leucocrossuromys), Eutamias, Tamias. Distribution: Palearctic and Nearctic regions.

KEY TO THE SUBFAMILIES OF THE FAMILY SCIURIDAE IN THE U.S.S.R.

1 (2). Toes unusually long and slender. Outer margins of fore- and hind legs with stiff pectinate fringes of hair which may be 5 mm long. This hair is especially long on the outer side and at the tip of the 5th toe of the hindfeet, where it forms a tuft which is longer than the claw.

Toes with black claws; longest claw usually longer than 1 cm, sometimes 1.5 cm.

Molars lophodont, that is, the crowns have plicated enamel loops.

Spermophilopsinae.

2 (1). Toes of normal length. Margins of legs without pectinate hair fringe.

Claws not particularly long. Molars bunodont, that is, tubercles on crowns with transverse elevated enamel folds.

3 (4). Ears long, often with tufts.

Tail long, luxuriant, with long hair. No cheek pouches.

Sciurinae.

4 (3). Ears short, rounded, forming only small folds of skin slightly protruding in some genera.

Tail with hair of moderate length. Terminal hair of tail longer than other hair.

Cheek pouches present, sometimes little developed.

Marmotinae.

327 Subfamily SCIURINAE, SQUIRRELS

Arboreal animals which build their nests on trees or in hollows. Fur on back of one color. Ears long, often with tufts.

Tail long, luxuriant, with dense and long hair. Forelegs with four toes and hind legs with 5 toes. Fourth digit longest on both fore- and hind legs.

Claws short, curved, adapted for clinging to the bark of trees. No cheek pouches.

Postorbital processes of frontals well developed.

Crowns of molars quadrangular, brachydont. Tubercles on molar teeth form transverse, elevated enamel folds.

Dental formula: $p\,\frac{3.4}{4}$; $m\,\frac{1.2.3}{1.2.3}$.

Form of glans penis varying, It is usually widened anteriorly and its tip inclined backwards as a blunt process (Sciurus) or a pointed process (Callosciurus).

Os penis large, cylindrical, with widened base and flattened tip, which forms a rounded plate the upper tip of which is inclined to the right. Anteroventral tip of os penis with a pointed, downward-directed process.

GEOGRAPHICAL DISTRIBUTION and genera of this subfamily are given above.

Genus **Sciurus** Linnaeus (1758)

1758. Sciurus Linnaeus C., Systema Naturae, I. editio 10, p. 63.

1893. Aphrontis Schultze E., Ztschr. f. Naturwissensch., Leipzig, LXVI, S. 165 (subgenus of the species Sciurus vulgaris). (sic!)

Mainly arboreal animals which climb well on trees, run and jump on branches and build nests in trees.

Back of one color without stripes. Tail (without terminal hair) 1/4 - 1/5 shorter than body.

Hair on tail very long, soft and directed laterally in ventral view.

Ears long, at least twice as long as broad. Hair on tips of ears very long, forming well marked tufts in winter specimens. Cheek pouches not developed.

Vibrissae arranged as follows: 1) the longest and thickest vibrissae between eye and nose; 2) above eyes; 3) on cheeks; 4) one single
328 vibrissa on the chin; 5) on the forelegs, on the outer side of the antebrachium; 6) 2 (very rarely 3) pairs on the belly.

Teats: p 1-1; a 2-2; i 1-1; total 8.

Premaxillary frontal processes widened, projecting at the sides of the nasals like wings. Width of posterior parts of premaxillary frontal process equal (rarely a little narrower, e.g., in S. aberti), and often greater (e.g. in S. carolinensis) than width of basal part of both nasals.

Coronal suture rounded (arcuate) or nearly rectangular, occasionally with two oblique, rounded processes, backwards-directed laterally. Subgenus Tenes characterized by sharply angular, backwards-directed processes at the sides of the coronal suture.

Interorbital space very wide, 37-50% of condylobasal length.

Frontal area of Palearctic species flattened or depressed to some extent. In American squirrels (Sciurus (Tamiasciurus) hudsonicus and Sciurus carolinensis) the frontal area is slightly convex, like that of chipmunks.

Braincase short and broad, angular and irregularly rounded*. The anterior part of the zygomatic arch, i.e., the zygomaxillary process, forms a vertical plate, not depressed horizontally.

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* The braincase of the American genus Tamiasciurus resembles that of chipmunks.

The infraorbital foramina are very small, laterally compressed, with small angular processes at the base. These processes are especially well developed in S. vulgaris and in the American S. niger. They are absent in Tamiasciurus hudsonicus.

Diastema of moderate length. Diastema about 1/5 to 1/6 longer than the row of upper molars.

Type species Sciurus vulgaris Linnaeus.

GEOGRAPHICAL DISTRIBUTION. Species of the genus Sciurus are widely distributed in the Palearctic, Nearctic, Neotropical and Oriental regions. They are not found in Australia, the Ethiopian Region or in Madagascar.

Two subgenera occur in the Palearctic Region, the subgenus Sciurus and the subgenus Tenes (Oreosciurus).

The following subgenera occur in North America: Tamiasciurus (which is in some respects transitional to the chipmunks), Baiosciurus, Sciurus, Guerlinguetus. The North American species are much more numerous than the Palearctic species; there are 34 species and 102 subspecies.

329 KEY TO THE SUBGENERA OF THE SUBFAMILY SCIURINAE IN THE U.S.S.R.

1 (2). Color of fur changing with the season. Belly white throughout the year. Soles of hind feet with 4 calluses. Teats 8. Two pairs of upper premolars.

Subgenus Sciurus Linn.

2 (1). Color of fur not changing or changing very little with the seasons. Belly various shades of rust-brown, or buff-yellow. Hind soles with 6 calluses. Teats 10. One pair of upper premolars.

Subgenus Tenes Thos.

Subgenus Sciurus Linnaeus (1758)

Color of fur changing with the seasons. Color of winter fur sharply different from that of summer fur. Belly white throughout the year. Hind soles with 4 calluses. Teats 8. Two pairs of upper premolars.

Type species: Sciurus vulgaris Linnaeus.

The geographical distribution of the subgenus has been given above in the description of the genus.

164. Sciurus vulgaris Linn. (1758). The squirrel

1758. Sciurus vulgaris Linnaeus C., Systema Naturae, X, 1758, p. 63 (Habitat in Europae Arboribus).

NAMES: Squirrel (English); das Eichhörnchen (German); l'écureuil (French).

LOCAL NAMES: belka sosnovka, elovka, berezovka (Russian hunters); belka chernaya, kedrovka, Shamanchik (Russian and Siberian hunters); vyvirka, bilka zvychaina (Ukrainian); vyvirka (Belorussian); wuorwantsch (Lapland); orre (Finmarken); arrew or oarre (Swedish-Finnish parts of Lapland); wanwaris (Lettish); orraw (Estonian); ur (Permyak and Cheremis-Mari); urne (Mordvinian); konue, kionne (Votyak); neeshs (Vogul—Mansi); leina and lengen (along the Sos'va); naksha (Chuvash-Etel); langi (Ostyak-Khanty along the Ob); n'aia (Ostyak-Khanty along the Kete); tabek (Ostyak-Khante along the Narym); tare, tarreku (Nenets); along the Yenisei - tareche; ur (Zyryan-Komi); mashi (Mescher); tiin (Bashkir); tiin or tikhu (Tatar); keermen (Kalmyk); yavunya (Koryak-Nymyllan); oloki (Orochen, Neni); kereme, kirme (Mongolian); kirmang (Buryat); lyrmo (Daurian); khumu (Mangun, Goldi, Nanai - along the Amur and the

Ussuri); kirmo (Kils along the Kura, Goldi and Nanei above the Ussuri, Birars, Manyagrs, Orochen-Neni, Daurians); ol'iki (Lamut); kirmi, khirmi (Soiot); koromon (Tungus, Evenk along the Khatanga); kirmun (Tungus-Evenki along the Baikal); uluki, ulyuki (Tungus, Evenki); ulukhi, ilukhi (Manchuria); ulyuki (Manegr); khulu (Goldi, Nanei); lafkor (throughout the inner part of Sakhalin); lakr (along the western coast of Sakhalin); lyakr, lakr, lakrs (Gilyak); yavunya (Koryak, Nymallan); raulen, uliki, rodlia (along the Anadyr); ting (Yakut); pogodzhub (Yurak, Odul); lerchieng (Tundra inhabitants, Yukagirs, Oduls); khuishu, Khui-dzhu, khui-ku-tzu [gray dog] (Chinese).

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(a swimming squirrel); p. 29 (a squirrel track); p. 32 (a wounded squirrel); p. 44 (a squirrel on a tree); 31) 331 Vinogradov B. S. and Obolenskii S. I., Vrednye i poleznye v sel'skom khozyaistve mlekopitayushchie (Harmful and Useful Mammals in Agriculture), Moscow 1932, p. 9 (entire animal); 32) Lobachev S. V., Verkhnevychegodskaya ekspeditsiya (An Expedition to Verkhnevychegod), 1932, p. 102, fig. 13; pp. 104-105, pp. 14-15; p. 109, fig. 16 (genital apparatus); 33) Stakhrovskii V. G., K izucheniyu biologii belki pri soderzhanii ee v vol'ere-parke (The Biology of Squirrels Kept in Open Air Cages), Zoologicheskii zhurnal, 11 (1); 82-104, 1932; p. 83, fig. 2 (photograph of squirrel); pp. 92-94, figs. 3-9 (photograph of young squirrels to compare their development); p. 101, figs. 12-13 (nest); p. 102, fig. 14 (diagram of molt); 34) Naumov N. P., Opredelenie vozrasta obyknovennoi belki (Determination of the Age of Common Squirrels); Uchenye zapiski Moskovskogo gosudarstvennogo universiteta, issue II, 1934, pp. 275-291; p. 281, fig. 1 (diagram of the abrasion of the surface of teeth); 35) Naumov N. P. Biologiya razmnozheniya obyknovennoi belki (The Biology of Reproduction of the Common Squirrel), in "The Ecology of the Squirrel" (Ekologiya belki), Moscow 1934, pp. 80-82, figs. 4-6 (molt diagram); p. 89, fig. 11 (diagram showing direction and sequence of fall molt); 36) Bobrinskii N. A., Ocherki promyslovykh zverei i ptits (A Survey of Commercial Mammals and Birds), Moscow 1934, p. 17 (plate with biological scenes); 37) Manteifel' N. A. Easpopov M. P., Isakov Yu. A., Lyubimov M. P., Biologiya zaitsev i belok i ikh bolezni (Biology and Diseases of Hares and Squirrels), Moscow 1935, pp. 40-42, figs. 3-5 (diagram of sequence of spring and autumn molt); p. 45, fig. 6 (population of squirrels); p. 46, fig. 7 (swollen teats in a gravid female); p. 48, fig. 8 (changes in the female genitalia); p. 53, fig. 9 (arrangement of vibrissae on the body of a newborn); p. 54, figs. 10-11 (young squirrels); p. 58, fig. 16 (structure of feet); p. 59, fig. 17 (development of ear, external morphology); p. 60, fig. 18 (development of incisors); p. 60, fig. 19 (young squirrels); p. 61, fig. 20 (head of an 18-day-old squirrel); p. 62, figs. 21-22 (40-day-old squirrels); p. 63, fig. 23 (nests of squirrels); p. 67, fig. 24 (diagram of structure of the squirrel nest).

MATERIAL EXAMINED: 1456 specimens.

DIAGNOSIS. Slender animal with rounded, blunt head; a sharp constriction between head and body. Ears long, about two or more times as long as broad. Tips of ears with long hair which forms tufts in winter specimens.

Tail (without terminal hair) almost as long as body and head. Hair on tail long, soft and directed sideways.

Hind legs long (Figure 164). In summer specimens, area between heel and paw with dense hair along the sides to the middle. Foot bare except for heels and margins. Four calluses at the base of the toes. The two lateral calluses stronger and longer than the inner calluses. Forefeet with 5 calluses. Anterior middle callus cordiform. The two calluses rounded. The 2 posterior outer calluses rounded. Inner lateral callus larger than outer callus.

Belly white. Back rust colored or black in summer and various gray shades in winter. Color of tail variable between rust-red, gray, brown and black.

333 Vibrissae present on head (between eyes and nose, on cheeks, and an unpaired vibrissa on the chin), on forelegs (outer side of antebrachium) and on belly (2, rarely 3 pairs). Teats: p 1-1; a 2-2; i 1-1; total 8.

Premaxillary frontal processes widened, wing-shaped laterally from nasals. Width of frontal process posteriorly equal or greater than that of both nasals in their basal part.

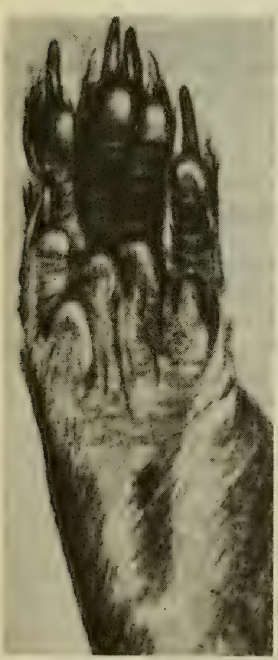
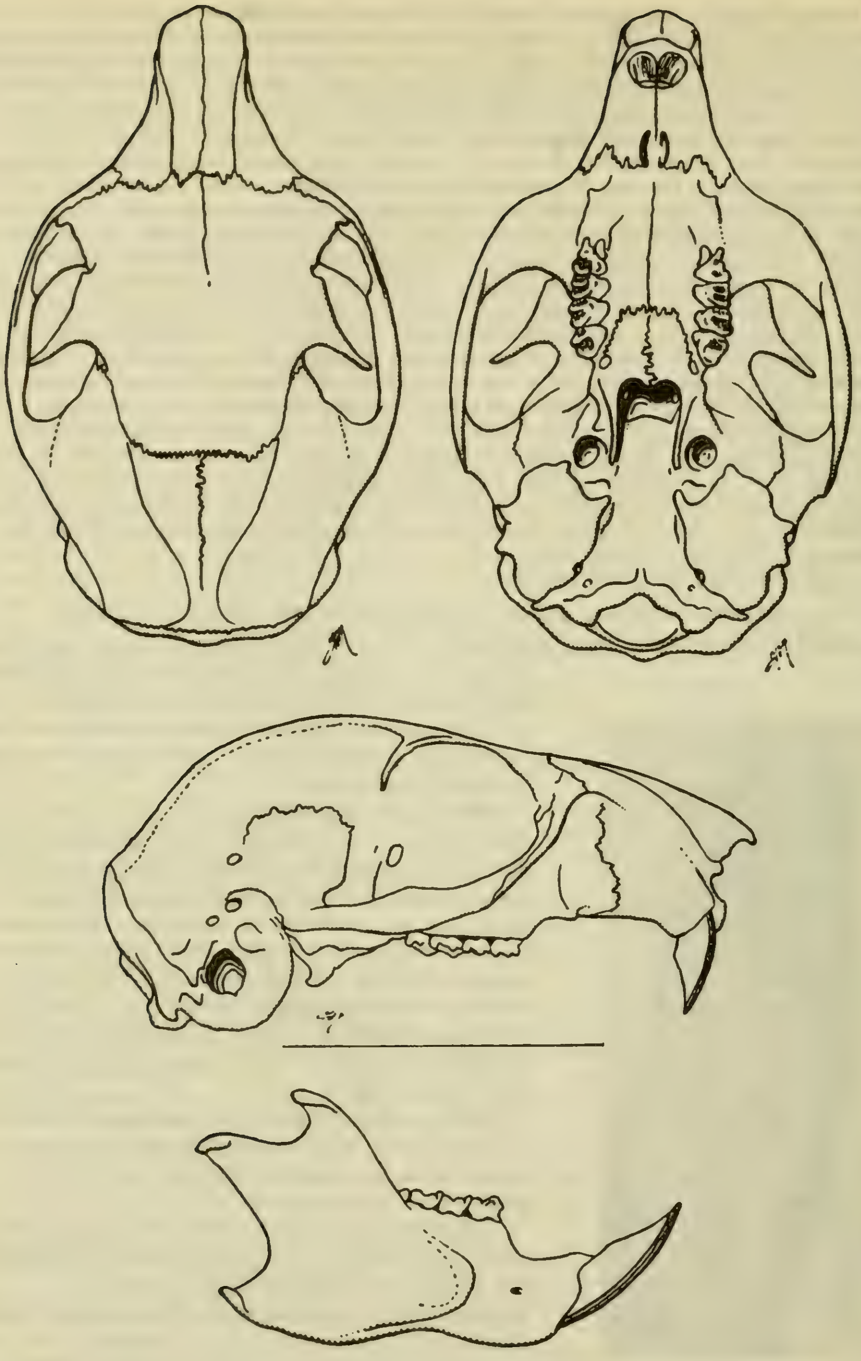


FIGURE 164. Hind foot of squirrel, Sciurus vulgaris L. Photograph by S. I. Ognev



FIGURES 165-168. Skull of squirrel, Sciurus vulgaris ognevi Migulin, No. M.1285 male, 12 September 1912, Moscow County, S. I. Ognev's collection

Drawing by Yu. A. Kostylev

Coronal suture rounded or nearly straight, sometimes with 2 rounded posterior processes. This suture, however, has no pointed, angular processes characteristic of Tenes anomalus.

Interorbital space very wide, 40-50% of condylobasal length. Bullae osseae longer than wide. Upper molar row shorter than bullae osseae.

Small upper anterior premolars present. They are less than one-quarter the size of the other premolars. Second upper premolar oblique and with a rounded crown.

ADDITIONAL DESCRIPTION. Rostrum short. Zygomatic arches rounded. Interorbital space and braincase broad.

Nasals much widened anteriorly and narrow at the base.

Premaxillary frontal processes wing-shaped, obliquely descending along the sides of the nasals. Its posterior part as wide as both nasals at the base.

Zygomatic arches rounded. Anterior parts of zygomatic arch slightly less apart than posterior parts. Postorbital processes thin, pointed and long, directed backwards and sideways.

Posterior part of the coronal suture nearly straight or slightly rounded convex posteriorly). Two sutures run from the coronal suture to the postorbital processes. Posterior part of coronal suture sometimes with two rounded processes, not pointed and angular as in the subgenus Tenes.

Tooth row much shorter than diastema. Bullae osseae longer than broad.

Molars with transverse enamel folds alternating with narrow grooves, and with small rounded enamel processes at the inner side.

First upper premolar very small and cylindrical, close to anterior inner oblique edge of second premolar. P^2 trapezoidal, its long side
334 directed outwards and its short side inwards. Inner side of occlusal surface of p^2 with a rounded or pectinate process which forms a nearly continuous crest along the inner side of the tooth row with the processes of the other teeth.

Outer side of p^2 with four processes. The first and fourth are of about equal size, and both are markedly lower than the second process. The third process is very small. The second and fourth processes are connected with the inner process by transverse enamel crests. M^2 of the same structure. M^3 differs clearly from p^2 and m^1: in addition to the inner process it has only one well marked outer anterior process and a slanting and wide posterior process. The first outer process is connected with the inner process by a transverse crest. The other surface of m^3 bears a shallow depression.

In the lower tooth row p^1 has two blunt denticles at the outer side. The anterior denticle is larger than the posterior and there is a very small process between these two. The inner side of the tooth has a large anterior process and a second blunt process of the enamel margin. A deep round groove in the middle of the crown. Two rounded denticles on each side of m^1. A marked depression between them in the middle of the tooth. M^2 the same, but with very small denticles on both sides between the 2 large processes. M^3 with two rounded processes on both sides of the anterior margin, and two small intermediate processes at the sides. A well-marked rounded posterior (third) process at the inner margin, which is connected with the low inner process by an elevated edge.

VARIATIONS OF SKULL AND TEETH OF SQUIRRELS DUE TO AGE. Two detailed papers on this subject have been written by M.K. Serebrennikov* and N.P. Naumov**.

M.K. Serebrennikov divides squirrels into age groups. He describes in detail squirrels up to the age of 6 months, of the stages juvenis and subadultus. He divides these two stages into four subgroups. The other stages (older than 6 months) are divided into two subgroups, viz. adultus and senex. Serebrennikov does not give a detailed description of the last.

Description of cranial characters of different ages of squirrels.

Juvenis. To the first stage belong blind squirrels a few days old, which feed only on mother's milk. The incisors have only just cut through and the molars are completely covered by mucosa. Condylobasal length 30-
335 31 mm; zygomatic width 21 mm. Skull oblong-oval; zygomatic arches little protruding; face very short compared with braincase. Bones very thin; fontanel nearly always present between frontals and parietals. The separate occipitals form small, occipital condyles in the exoccipital zone. Interparietal, parietals and posterior half of the frontals form an almost ovoid surface. Nasals very short and wide.

The mandible differs sharply from that of adults, it is elongate and its processes are little developed. It is 23 mm long and about 11 mm high.

The second stage differs from the first in the presence of two milk premolars. The rostrum is relatively longer compared with the occipital region. The ratio of length of the facial region to length of the braincase is 13:27. All bones are connected by more solid sutures than in the first stage. The fontanel becomes ossified. The occipital condyles grow considerably in size and are situated on the basioccipital. Condylobasal length 34 mm.

Lower anterior milk premolars cut through. Mandible 23.8 mm long and 11.7 mm high.

Third stage. The first true molars appear. Condylobasal length 38 mm. Zygomatic arches 25 mm wide, more widely apart laterally. Length of facial region to length of braincase = 14:30.

Mandible growing more in height than in length. Height to length of mandible = 12.9:26.

336 In the fourth stage four molars (premolars + molars) are present. Only the third posterior molars are absent. Condylobasal length about 41-42 mm, zygomatic width about 25-26 mm. Skull generally longer than wide. Facial length to length of braincase = 16.6:32.

Height of mandible to length = 14:27.

According to M.K. Serebrennikov the juvenis stage continues until the growth of the third posterior molar. The period lasting until the final replacement of deciduous teeth by permanent molars forms the subadult stage.

Subadult. First stage. This age is easily determined by examination of the upper deciduous premolars. The crown of the second upper premolar is very small and has a laterally compressed anterior root. The anterior limit of this root is usually at the same level as the first small premolar. The anterior root of the second premolar usually reaches beyond the first premolar. The first premolar has one process and is very small. It is lower than the molar row and its inner side is inclined against the anterior root of the second premolar. The first premolar is loosely attached as its alveolus has only one root (Figure 169, 1).

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* N.K. Serebrennikov, "Variations and the Growth of the Skull of Squirrels Due to Age" (Vozrastnaya izmenchivost' i protsess rosta cherepa u belki), Ezhegodnik-Zoologicheskogo muzeya Akademii Nauk, 1930, pp. 399-418.

** N.P. Naumov, "Determination of the Age of Squirrels" (Opredelenie vozrasta belki), Uchenye zapiski Moskovskogo universiteta, II, 1934, pp. 275-291.

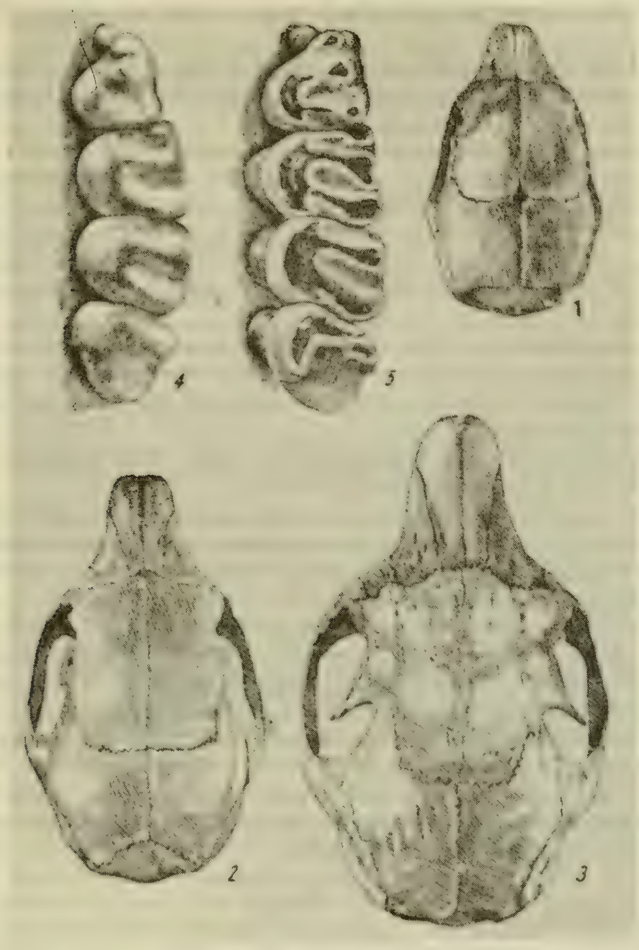

FIGURE 169. 1-skull of young squirrel of the first stage; 2 - skull of young squirrel of the fourth stage; 3 - skull of adult squirrel; 4 - molars of adult squirrel; 5 - molars of old squirrel (after M. K. Serebrennikov)

The second stage of the subadult starts when the permanent molars begin to differentiate under the two deciduous premolars, ending when the first deciduous premolar falls out. The condylobasal length at this stage is about the same as in adults — 45.7 mm. Zygomatic width about 29 mm. Ratio of facial length to length of braincase = 20:34.

The third stage of the subadult lasts from the loss of the first deciduous premolar until the loss of the second deciduous premolar. The boundaries between the interparietals disappear at this stage as the sutures close and converging crests form on the braincase. These crests bifurcate anteriorly, reach the base of the postorbital processes and form a lyre-shaped figure.

The period from the loss of the second premolar to the appearance of the permanent premolar forms the fourth stage of the subadult (Figure 169, 2).

The growth of the teeth and the replacement of the single deciduous premolar on the mandible which corresponds to the second deciduous upper premolar is the same as in the upper tooth row.

The adult stage is characterized by full development of the tooth row. The braincase bears lyre-shaped crests in adults. These crests begin with closely placed ridges from the lambdoid crest and continue through the
337 interparietal region. They diverge widely anteriorly and continue to the posterior base of the postorbital processes, forming the typical lyre-shaped figure. About 2/3 of the sagittal suture and the frontal suture become fused (Figure 169, 3).

The skull becomes oblong. The adult skull differs markedly from that of the juvenis, being much straighter in profile. The juvenile skull in profile has its highest point at about the middle of the frontals; the adult skull near the coronal suture.

The adult mandible is almost 2/3 as high as long. The juvenile mandible is about 1/2 (even less) as high as long.

Senex. The old skull has frontal and sagittal sutures completely fused; the lyre-shaped crests are well developed, a lambdoidal crest is present, and all cranial bones are relatively thick. The crown of the teeth of old specimens is much worn off.

N. P. Naumov studied the changes of the teeth due to age. Although the enamel of the crowns is worn off in a certain order, abrasion is influenced by different kinds of food. Solid food accelerates abrasion of the teeth. On the other hand, soft food like mushrooms and berries retards abrasion. These variable factors make it difficult to exactly determine the age of squirrels from the form of the teeth.

N. P. Naumov (loc. cit, pp. 280-283) gives a good synoptic table from which the age of squirrels can be determined according to the structure of the upper molars[*]. (see Figure 170, p. 297).

I. KEY TO MAIN AGE GROUPS.

A. Upper tooth row incomplete. Permanent molars either absent or breaking through. The tooth row (including molars and deciduous premolars) does not have a straight upper surface formed by crowns of the same size. Cranial bones very thin. Zygomatic arches narrow and hardly protruding laterally - young (juvenis), 2-3 months old.

B. Upper tooth row complete but including deciduous teeth, i. e., two first premolars. Surface of p^2 triangular, its cross section about half as wide as m^1. Anterior root of p^2 projecting far anteriorly, sometimes reaching beyond alveolus of p^1: subadult, up to one year old.

C. Upper tooth row with only permanent teeth. Upper surface of p^2 only little narrower than m^1. Occlusal surface of p^2 trapezoidal. Anterior root of p^2 never reaching beyond alveolus of p^1: adult.

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[*] This table has been modified and corrected in some details.

A. Tooth row not yet with level surface i. e., p^2 much lower than m^1: subadult less than one year old.

B. Occlusal surface of all teeth at one horizontal level (tooth row fully developed).

a. Dentine not exposed at inner crest. All molars with "young" (sharply tuberculated) crowns. Outer tubercles not worn off, or little worn, so that their height is little decreased. Polished "mirrorlike" surfaces absent, or present only in narrow, disconnected areas. Dentine occasionally exposed in these areas, rarely visible on the outer tubercles and even more rarely on the transverse crests. Dentine not exposed along the inner pectinate tubercles: 6-12 month old squirrels (Figure 170, 4).

b. Dentine exposed on inner pectinate tubercles. Dentine exposed either in small yellow or dark, spindle-shaped depressions, or as a continuous dentine network on all projecting parts of the surface. Polished, mirrorlike enamel surfaces present on all tubercles and transverse crests forming a network all over the tooth. They are easily visible with the naked eye.

a^1. Areas of exposed dentine on elevated parts of the surface, disconnected and not forming a general, continuous dentine network.

a^2. First or second tooth with areas of exposed dentine along inner crests. Dentine is exposed on the transverse crests and on the high external tubercles which are worn and about 3/4 of their normal height: specimens more than 1 year old. (Figure 170, 5).

b^1. All teeth (except p^1 which remains almost unchanged) with areas of exposed dentine along inner crests. Teeth considerably worn and their high external tubercles 1/2 - 3/4 of their normal height. A polished enamel stripe around the areas of exposed dentine all over the convex parts of the occlusal surfaces: more than 2 years old. (Figure 170, 6).

b^2. Areas of exposed dentine either connected and forming a general network over the surface or mostly connected along the inner tubercles connected with areas along the transverse crests.

c^2. Network of dentine absent. Spots of dentine connected along inner tubercles and anterior transverse crests of m^1 and m^2 (sometimes also of p^2). Projecting rings of enamel present along the network. The outer tubercles are worn, half their normal height, or less: more than 3 years old (Figure 170, 7).

d^2. Network of dentine present all over the tooth and bordered with projecting ridges of enamel. The surface of exposed dentine occupies about 1/4 of the occlusal surface. Crowns of the teeth with very low (strongly worn) tubercles: more than 4 years old (Figure 170, 8).

e^2. Network of dentine present all over the tooth. The enamel spots near the depressions begin to disappear. Exposed dentine covers 1/3-1/2 of the surface. Crowns flat, without tubercles: more than 5 years old (Figure 170, 9).

f^2. Exposed dentine covers more than half of the occlusal surface. Surface of the teeth depressed: more than 6 years old (Figure 170, 10).

339 The color of the squirrels is very variable and the variations are described under the various subspecies.

The belly of all forms of Sciurus vulgaris is white. However, the size of the white area is variable. In Russian-European squirrels and in the West Siberian subspecies the white area covers the area from chin and throat to the groin and also white spots on the inner side of the legs. It is reduced in central and East Siberian squirrels. Dark fur is present on the sides of the throat and reaches the chin. As a result, a narrow triangular figure of white is present on the throat. The white color is also strongly reduced in the inguinal region and on the spots on the inner sides of the legs. The inguinal region is often dark.

Color of back varying with age and season. In east European summer specimens, back different shades of red-brown-rust to deeper dark brown tones. Back of central Siberian and East Siberian squirrels dark brown, often black. The color of squirrels from mountainous regions is more intense than that of squirrels from the plains.

Winter specimens sometimes show so-called "baldness" of the spine. This consists in the appearance of a rust-colored stripe along the spine in winter fur. Such pelts should not be confused with late autumn pelts with remains of rust-colored hair on the spine.

The following color types of the tail are found:

Black-tailed: Tail with completely black hair.

Dark-tailed: Tail black-gray. The roots of the hair are dark gray and the tips black.

Brown-tailed, tail brownish. The hair has gray roots, rust-colored central parts and black tips. This group is divided into two subgroups, dark brown-tailed, and light brown-tailed.

Red-tailed specimens with rich rust-colored tail. The hairs have gray roots and rust-colored tips.

Dark red-tailed: Many specimens of the Yenisei squirrels. Their tail is reddish rust-brown with a strong admixture of deep black-brown or black tone. Roots of hair smoky bluish gray; middle parts rich rust-brown, broad black or black-brown subapical bands and rust-colored tips.

Gray-tailed specimens: tail generally of a silver-gray tone.

The vibrissae of Sciurus vulgaris have a typical distribution. A group of small vibrissae present near the lips, and larger vibrissae along the sides of the nose, close to those on the lips. A small group above the eyes, the longest may be 25 mm long. Four or five vibrissae, about 35 mm long, in a dense group on the cheeks behind the eyes. Several vibrissae on the outer parts of the antebrachium, about 25 mm long. B. A.
342 Kuznetsov (1928) found a group of six short vibrissae on posterior side of the foreleg, at the base of the wrist. I. P. Kiris who studied the structure and distribution of vibrissae came to the conclusion that the hairs at the base of the wrist are not vibrissae. Two separate pairs of long vibrissae on the belly. The first pair on the chest posterior to the base of the forelegs. The second pair about 2 cm behind the first. These vibrissae are 30-35 mm long. They are directed backwards and lie close to the body, only slightly projecting from the fur. The vibrissae have a rather constant form, they are straight, stiff, tapering at the tip. They project clearly from the fur. Their color is constant, and does not depend on the age of the animal or the season. The vibrissae of the head are dark brown, almost black. The vibrissae on the feet are rust-colored, sometimes yellowish. Some of them have dark bands. The vibrissae on chin and belly are white.

The forefoot has four toes. The first is much reduced. The second is about as long as the fifth; both are much shorter than the third and the fourth. The third is nearly as long as the fourth.

The first toes of the hindfoot is the shortest. The third and the fourth are of about the same length. The second is shorter. The fifth toe is thicker and longer than the first, but shorter than the fourth.

SYSTEMATIC NOTES. Sciurus vulgaris in the U.S.S.R. forms 16 or 17 subspecies which have transgressive characters. Each subspecies is connected with the adjacent subspecies by transitional forms. Some of these subspecies are closely related showing a definite composition of characters such as a certain combination of colors on the tail, bald-spine in winter, density and luxuriance of fur, etc. It is often difficult to identify a single specimen because some characters become evident only in series. Some subspecies can be easily identified from single specimens, e.g., S. vulgaris kessleri Migulin, S. v. bashkiricus Ogn., S. v. exalbidus Pall., etc.

The following subspecies occur in Western Europe: 1) Sciurus vulgaris vulgaris L. — Scandinavia; 2) S. v. leucurus Gmel. —

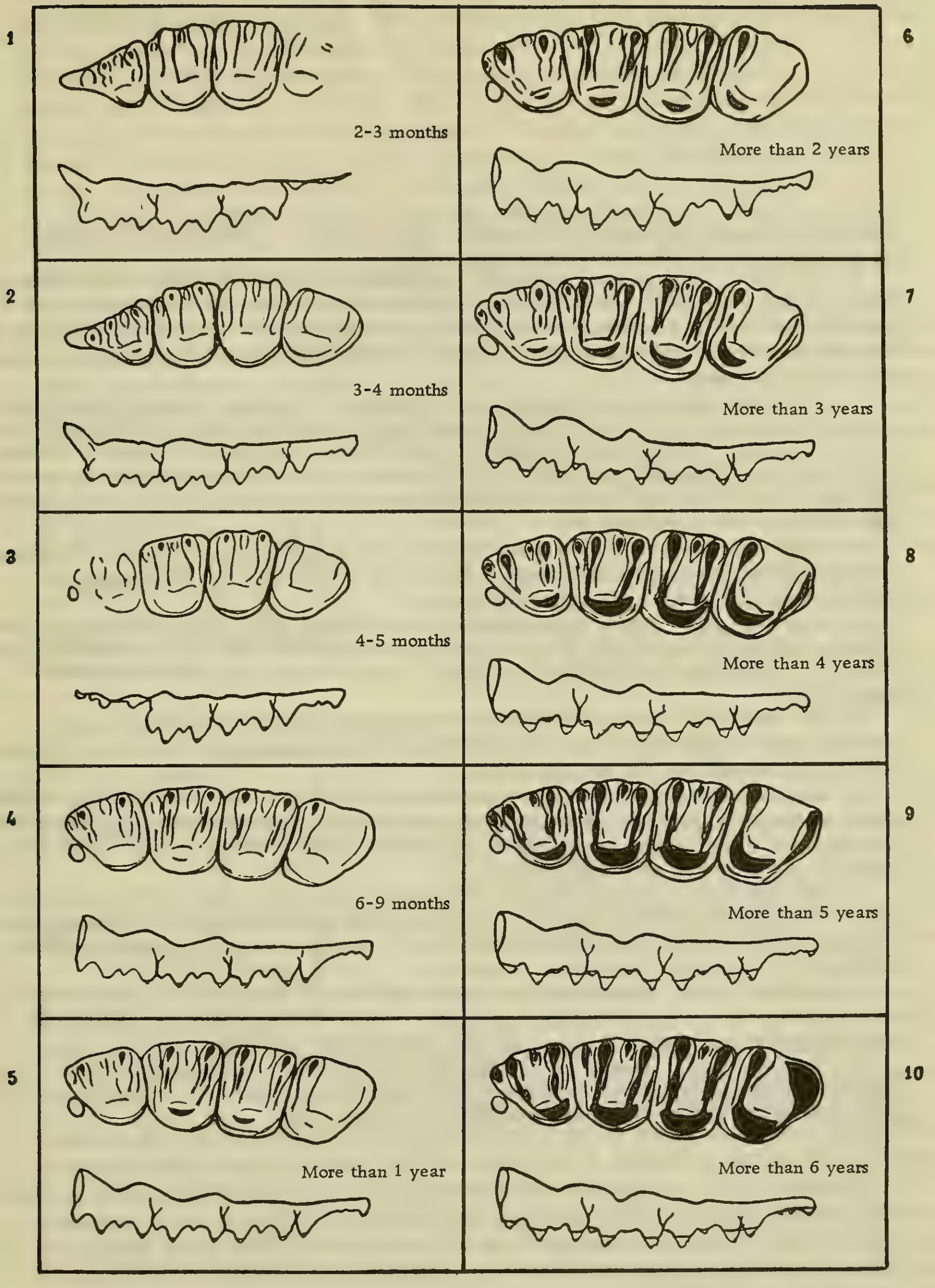
1
2-3 months
6
More than 2 years
2
3-4 months
7
More than 3 years
3
4-5 months
8
More than 4 years
4
6-9 months
9
More than 5 years
5
More than 1 year
10
More than 6 years

FIGURE 170.

FIGURE 170. Stages in the abrasion of molars of Sciurus vulgaris L. Description of the principal age groups of the squirrel after changes in the upper tooth row.

1. 2-3 months. Upper tooth row incomplete, third molar (m^3) not yet cut through or only beginning to erupt; second premolar (p^2) deciduous, its crown triangular. Its occlusal surface about half the size of that of the first molar (m^1). Anterior root of p^2 strongly projecting forward. First premolar usually absent. Areas of exposed dentine (the bony substance of the tooth under the enamel) present only on the large outer tubercles of second premolar.

2. 3-4 months. Upper tooth row complete, only p^1 absent. p^2 deciduous. Areas of exposed dentine on outer tubercles of p^2 and m^1. A fine line of exposed dentine sometimes present on inner tubercle of p^2.

3. 4-5 months. Tooth row usually incomplete or not yet level. Deciduous p^2 replaced by permanent tooth. Deciduous p^2 sometimes persisting on one or both sides of maxilla, but the new permanent tooth is visible beneath it. In this case, the deciduous tooth is raised by the permanent tooth and projects markedly above the surface of the upper tooth row.

4. 6-9 months. Upper tooth row complete and level. All teeth permanent, fully grown. Small spots of exposed dentine on the large outer tubercles of all teeth. Short lines of dentine sometimes on the transverse crests of m^1 and m^2, and on inner tubercle of m^1.

5. More than 1 year. Areas of exposed dentine on outer tubercles of all teeth oblong-pyriform. Only m^1 and m^2 with spindle-shaped areas of exposed dentine on the transverse crests. Inner tubercles of m^1 and m^2 with well-marked crescent-shaped areas of dentine. Rarely a faint line of dentine on the inner tubercle of m^3.

6. More than 2 years. Spots of dentine on the large outer tubercles fused with dentine areas on transverse ridges. Crescent-shaped areas of dentine on inner tubercles of all teeth; that on inner tubercle of p^2 usually less marked than on the other teeth.

7. More than 3 years. Small tubercles on outer margin of teeth also worn, with small spots of dentine. Areas of dentine on m^1 fused into a horseshoe-shaped figure with apex directed inward. Transverse stripes of dentine on m^2 and m^3 close to enlarged falcate dentine spots on inner tubercles, but not reaching them. Posterior margin of m^3 with small dentine stripe.

8. More than 4 years. Area of exposed dentine markedly increased, covering about a quarter of the surface. Transverse dentine stripes coalesced or almost coalesced with dentine spots on inner tubercles of all molars, forming horseshoe-shaped figures on m^1 and m^2. Dentine area on m^3 of the shape of half a horseshoe.

9. More than 5 years. Dentine bare on all tubercles and crests of upper tooth row. Area of dentine network covering about 1/3 of the surface. Dentine spots on transverse crests and inner tubercles fused with the horseshoe-shaped figures of p^2, m^1 and m^2. Posterior margin of m^3 strongly worn.

10. More than 6 years. Dentine area covering about half the surface. Tubercles and crests of all four teeth little elevated above surface. Dentine spots on all teeth horseshoe-shaped. A considerable part of the concave surface of the crown of m^3 worn (according to I. D. Kiris, 1937).

England; 3) S. v. russus Miller — western and central Europe, from Britanny to Holland and central France; 4) S. v. fuscoater Altum — 343 eastern and central Europe, Germany to Austria, Hungary and Rumania; 5) S. v. italicus Bonaparte — Italy; 6) S. v. lilaeus Miller — Agoriani, north of Lyakura — Parnassus in southern Greece; 7) S. v. ameliae Cabrera — Greece; 8) S. v. alpinus Desmarest — Pyrenees; 9) S. v. numantius Miller — Spain, Pinares de Quintanar de la Sierra, Burgo; 10) S. v. infuscatus Cabrera — Spain, Las Navas, Avila; 11) S. v. segurae Miller — Spain, Molinicos Sierra de Segura; 12) S. v. baeticus Cabrera — Spain, Alapis, Sevilla Province. The following subspecies occur in the Far East: 13) S. vulgaris orientis Thos. — described from Hokkaido (Yezo); according to O. Thomas squirrels from the vicinity of Seoul in Korea are closely related to this Japanese form. Thus, 30 Palearctic subspecies of Sciurus vulgaris are known so far.

343 GEOGRAPHICAL DISTRIBUTION. (Map VI). According to F. D. Pleske (1884) the northern boundary of squirrels in the Kola Peninsula is connected with coniferous forests. North of the Imandre squirrels are rare. Pleske obtained a specimen from Raznovolok (north of the Imandre) and saw pelts from the Kola Peninsula. In Eastern Europe the range of the squirrel reaches nearly to the Arctic circle, north as far as the forest belt. The northern boundary crosses the Urals at about the Arctic circle, and turns south between the Ob and the Taz (see map). S.I. Orlov (1930) writes as follows on the distribution of squirrels in these parts of Siberia: "In the Taz District north of Syurge (67°20' N and 49°50' E), many natives never caught squirrels except in 1923, during the mass northward migration of squirrels on the left bank of the Taz. In autumn of this year a large number of squirrels reached the Taz Bay and tried to swim across to the right bank. They drowned because they were exhausted from the long journey and from hunger, as they could not subsist on the few dwarfed larch trees in the tundra. In spring 1924 I found several nests in which the squirrels had frozen to death in an alder grove in the estuary of the Kopur river. The dead squirrels were very emaciated, their stomachs contained only moss and water, and their fur showed many bare patches... The squirrel is common along the Tur and 344 Taz rivers (250 km from their estuaries), but occurs only in small numbers. East of the Taz river the squirrel reaches the sources of the Turukhan river and farther east Lake Khantaiskoe where it was caught by the Yuraks and the Khantaika Tungus. . . Farther east the boundary apparently turns south, as squirrels were not found along the Khatanga Highway. In my collection is a specimen from the Rossomazh'ev Station. According to the Yakuts squirrels are very rare along the Kutoi river near the estuary of the Kotuikan, although there are forests there. Squirrels do not occur along the Khatanga where the forest is 4.5 m high."

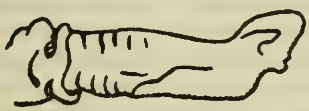

FIGURE 171. Glans penis of squirrels (highly magnified)

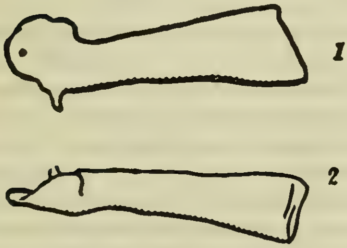

FIGURE 172. Os penis of squirrels. 1 - lateral; 2 - dorsal (highly magnified)
Drawing by Yu. A. Kostylev

These data are confirmed by observations of E.O. Yakovlev (1930). The squirrel is widely distributed in the Turukhansk Territory, spreading far north. It was found near Khatanga along the lower reaches of the Kheta river. It is common along the right tributaries of the Kheta river (e.g., Ayakla river), at about 70° N. In the Pyasinsk District the squirrel was found near the village Tungusy (70°30' N). It rarely reaches the village Dudinsk near the Yenisei (about 69° N). Farther west it is found along the Malaya Kheta river. It was not found farther north. According to R. Maak (1886), it is very rare along the Olenek river (about 68° N). The northern boundary of squirrels between the Yenisei and the Lena thus reaches 70° N or a little beyond.

East of the Lena the boundary crosses the Yana and Indigirka rivers south of 68° N. According to V.I. Iokhel'son (1898), the squirrel disappears northwest of Srednekolymsk, near the circumpolar belt. Numerous squirrels occur on the right, "stony" bank of the Kolyma between the upper reaches of the river and Anyuev.

In the Anadyr Territory the squirrel is apparently restricted to isolated larch forests. According to N.P. Sokol'nikov (1927), there is such a forest, 170 km wide, 50-60 km north of Markov. Another is found on the upper reaches of the Maina beginning from its tributaries, the two Algans. This forest is smaller than the forest near Markov. These forest islands are generally very small, 1-3 km wide, according to Sokol'nikov. They are separated from the east Siberian forests by tundra. In the Anadyr Territory the squirrel occurs along the Shchuch'ya, Yablona and Yeropol rivers (S.N. Barmontov (in litt., 1933)).

The squirrel does not occur in the tundra north of Kamchatka. It has been generally accepted that squirrels do not occur in the Kamchatka forests. The first data on the invasion of Kamchatka by squirrels appeared in the 1920's. According to P.T. Novograblenov (1930), the migration of squirrels to Kamchatka from the Gizhiga and Penzhino districts began in 1923/24. The spread of squirrels was as follows: from the Tigil' Valley they passed through the Anaun Valley to the Kozyrevka river. They thus reached the Kamchatka valley where they moved in both directions. They then passed to the Avacha Valley. According to S.N. Barmontov (in litt. 1933), squirrels were found along the Dvugortochnaya and Kamchatka rivers (and the tributaries of the latter). They were numerous in the Mil'kov — Naniki districts, and gradually moved south to the Petropavlovsk District (Koryaki, Elizova, Nalychevo, Nikolaevka villages).

345 The northern boundary at the extreme eastern corner of the range of Sciurus vulgaris thus reaches the northern part of Kamchatka.

The southern boundary of the range. S. vulgaris occurs in the forests of northern Bessarabia and in Podolia. It was found in the following localities, which are isolated from the main range: the Birzulo-Zherebkov forests in the Tiraspol District near the Dniester (A.A. Brauner, 1923); the deciduous forest in the former Aleksandriiskii County, the Grinen Forestry of the former Tul'chinsk District (A.A. Migulin), the Samara Forest along the Dnieper.

Farther east the southern boundary passes south of the former Kiev Province in the Zvenigorodka District, Cherkas (A.A. Migulin, "Mammals of the Khar'kov Province" (Mlekopitayushchie Khar'kovskoi gubernii), 1924). On the left bank of the Dnieper the boundary follows 50° N.

According to N. Gavrilenko (1928), squirrels still occur in the eastern part of the former Poltava Province in the northern part of the former Konstantinograd County. According to A.A. Migulin (1924), the range of the squirrel includes the Valok and Zmiev districts. The boundary then turns sharply north near the Khar'kov and Kura steppes to Sumam, L'gov, Dmitriev, including forests of the former Trubchevsk, Briansk and Karachev counties. Squirrels were found in the following places, which are separated from the main range: near Izyum (A.A. Migulin), the Belgorod District (Shebenin, Nizhegol' and Murman forestries), Serebryan Pine Forest of the former Artemovskii District.

According to S.N. Gorbachev (1915), the squirrel occurs near Orel, near the village Mylinki (former Karachevsk County). The boundary then runs north to include the Bolkhov, Zhizdrinsk, Kozel', and Kaluzh forests and the northern forests of Tula Province. Farther east the squirrel is found in the forests of the former Ryazan Province, in the former Ryazan and Kazimov counties (S.S. Turov, "Mammals of the Ryazan Province" (Mlekopitayushchie Ryzanskoi gubernii), 1925, p. 59), in the Morshansk, Kadomsk and Temnikov forests of the former Tambov Province. The squirrel is widely distributed in the former Penzen Province (F. Fedorovich, 1915). According to B.M. Zhitkov (1898), the squirrel was once common in the former Simbir Province in forests of the former Ardatov County. They are more common in the Lukoyanov and Sursk forests. The boundary then turns sharply north, crossing the Volga between 55° and 56°N.

There are several records in the forests of the Chernozem Region in the south. Squirrels were also found farther north, isolated from the main forest.

N.A. Severtsov (1855) found the squirrel in the Khrenov Forest (former Bobrovsk County of the former Voronezh Province), in the Graf Forestry (near Voronezh), in the Shipov Forest (former Pavlovsk County) and in the Lipov Forest.

In "The Fauna of Terrestrial Vertebrates of the Voronezh Province" (Fauna nazemnykh pozvonochnikh Voronezhskoi gubernii), 1923, p. 153,
346 I wrote "Squirrels have become very rare in the Khrenovsk Forestry. During long and regular expeditions we only once caught a young squirrel (22 July (4 August) 1921). We also received the pelt of an old winter specimen from the forester of the Maidan Forest Belt. S.I. Ognev shot a female on 22 September (5 October) 1920 in the Graf Forestry not far from the Graf Station.

"N.N. Spitzyn, the forester of the Graf Forestry states that squirrels were formerly very common in forests near Voronezh. Their sharp decrease is apparently the result of the increase of martens. I.D. Tushnev told us that in the Shipov Forest the squirrels are being exterminated by the numerous martens.*

"P. Barants (in litt., 1895) writes that the squirrel is very common in the Khrenov Pine Forest. It occurs both in pine forests and in deciduous forests near the river. The squirrels have decreased considerably in the last decade. In the late 1880's and the early 1890's they were very common in the forest. At present (1895) squirrels occur in the forest but only in small numbers."

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* It seems more plausible that the squirrel population in the Khrenovsk Forest decreased as a result of lack of food in years with poor crops of cones and nuts. The food supply of squirrels in the Shipov deciduous forest is generally poor.

Squirrels occur in the Tellerman Pine Forest (former Borisogleb County of the Tambov Province, along the Khotra river). A.A. Silant'ev (1894) wrote that squirrels are very rare in forests of the former Balashov County, Saratov Province. The range of the squirrel in this region was apparently isolated from the main range. In the middle reaches of the Volga the squirrel apparently occurs south to the line Serdobsk, Petrovsk, Syzran and Vol'sk.

In the Trans-Volga Region the squirrel survived sporadically in the central part of the former Kazan Province (e.g., in the Cheremshan Forest along the Cheremshan river). It does not occur on the left bank of the Belaya river. It occurs rarely in forests on the right bank of this river, e.g., in the Angasyak Forestry of the former Birsk County of the Ufa Province. The occurrence of squirrels in the Bazuluk Pine Forest is isolated from the main range. Farther east the squirrel occurs on the southern Urals, in the Zlatoust District, on the Ilmenskii Range (Dukel'skaya, 1928). According to N.A. Zarudnyi (1897), it is common in forests of Orenburg Bashkiria, M.K. Serebrennikov (1929) obtained 2 squirrels from the eastern part of the Chelyabinsk District. A.I. Argyropulo found squirrels in the Troitsk District. Farther east the southern boundary continues through the south of the former Tobolsk Province (the Tara District) and, skirting the Barabinsk steppes, enters the central part of Tomsk Province. It then turns sharply south to the Altai Region. The west Siberian subspecies Sciurus vulgaris exalbidus occurs in isolated localities in "ribbon" pine forests along the Irtysh and the upper reaches of the Ob.

347 The southern boundary of the squirrel in the southern Altai Region is not well known. It apparently occurs in Tarbagatai, the southern Altai, the Tannu-Ola Range, the Sayan Mountains, in forests of the Uryankhai Territory, and on the Kentei Mountains. The squirrel occurring in the Kontey mountains is apparently closely related to the Altai squirrel. The southern boundary then reaches the southwestern shore of Lake Baikal. In Transbaikalia, the squirrel occurs throughout the forest zone, beginning from the Barguzin forests. It occurs throughout the Great Khingan, the north Manchurian forests and Korea.

The squirrel also occurs in Japan and in Sakhalin.

The distribution of the squirrel in this large area is not uniform. Its numbers fluctuate markedly because of food supply and the varying rate of reproduction. The squirrel is subject more than other animals to fluctuations in numbers in different localities.

MODE OF LIFE. The squirrel depends on the forest. Absence or presence of forests thus results in absence or presence of squirrels.

In different regions of its range the squirrel prefers different types of forest. Its choice depends mainly on the presence of food. When there are many spruce cones the squirrels concentrate in spruce forests. When there is a yield of pine cones they move to pine forests. When there is a crop of hazelnuts they move to the nut trees, etc. However, other factors also influence the choice of habitat: density of the trees, the presence of fallen and hollow trees, and the density of the undergrowth. These factors enable the squirrel to hide from enemies, mainly from birds of prey. They also supply sites for nests, e.g., dense undergrowth and tree holes.

The suitability of a locality for squirrels is determined by the grass-shrub layer of the forest, the presence of a dead moss layer, the quality of the soil, etc. Of great importance is secondary food such as mushrooms and berries. An important factor is the presence of small competitive rodents on the ground which eat the fallen cones and nuts. The grass layer of the forest also affects the squirrels, as it serves as habitat for these small rodents. In spite of the variety of habitats inhabited by the squirrel, in any region there are some forests which are most suitable to be permanently inhabited by squirrels.

In the Moscow Region, the squirrel lives mainly in forests in which
348 spruce predominates. It usually builds its nest where the spruce forest is dense. According to B.A. Kuznetsov (1929), in the Pogonno-Losinoostrovskii Forestry the squirrel most frequently occurs in underbrush in pine and spruce forests, in linden-spruce forests and spruce nurseries. It rarely occurs in young spruce-larch and pure larch associations. The squirrel enters this region from the high forest. It is especially numerous in pine forests and in underbrush in pine forest with spruce in the second layer. It is very rare in old pine trees with reindeer lichen which has no undergrowth of spruce. Although such forests produce abundant cones, they are less suitable for squirrels as the trees are widely spaced, and there is much light and little shelter against predators. The cones in these forests are mostly eaten by woodpeckers and crossbills.

S.V. Lobachev (1932) gives a detailed account on the habitats of squirrels in the northern European U.S.S.R., in the Verkhnevyechegod District. Squirrels occur in this region in the following types of forests:

1) "Parms", i.e., spruce forests on sandy loam, loam, clay and soils in humid valleys with a base of moraine clay. "Parms" are the principal habitat of the squirrels.

2) Spruce marshes overgrown with few, low spruce with grass cover consisting of sedge, rushes, etc.

3) Birch forests with spruce underbrush.

4) Pine forests, e.g., these with moss ground or marshes and pine-birch forests.

The squirrel is never found in birch groves, peat-bogs, pine marshes, and burns with new young birch.

In the south, e.g., the Graf Forestry of the Voronezh Region (former Voronezh County) the squirrel occurs in oak forests (where it feeds on acorns), and also in mixed forests with pines. According to A.A. Migulin (1924), squirrels occur in the former Kharkov province both in pine forests and in broad-leaved forests. They are particularly common in pine forests mixed with deciduous trees.

As mentioned above, the squirrel moves to different habitats because of fluctuations in the food supply. It therefore spends some time in different types of forest.

A detailed description of the occurrence of squirrels in certain types of forest is given in an article by I.D. Kiris (1934), who studied the ecology of the central Ob squirrel.

1. The characteristic habitat in the Surgut Territory is "insular forests". These are characterized by: a) separation from the taiga by large meadows (called "sors"); b) the small area of each forest island; c) the prevalence of stone pine stands over other forest types; d) rich food supply in the rare productive years, and almost complete lack of food during the long periods of crop failure.

The squirrel does not nest or reproduce in insular stone pine forests. It may spend years there, during years with a rich harvest of nuts.

349 2. The second habitat may be called "principal inland stone pine forests" or "urmans". Large areas are covered by stone pine stands which have broken borders making the margins of the forest very long. These are the most suitable habitat of the squirrel. There is a rich and constant food supply because of the presence of many coniferous trees besides stone pine. The seeds of these trees diversify the food of the squirrel. This habitat also has a good development of the various stories of the forest, providing good shelter.

The squirrels live constantly in "urmans", reproduce and molt in them. According to I. D. Kiris, nests are most frequently found in stone pine urmans. He found an average of 0.139 squirrel nests per kilometer.

3. Large fir and spruce forests, which often pass gradually into stone pine forests. Here the squirrel finds good shelters and a constant food supply.

The squirrel is uniformly distributed in fir and spruce forests. However, the density of population is much lower than in urmans, except for during the molt, when the squirrel is even more numerous here than in urmans.

4. In pine forests which are separated from other habitats and far from urmans, the squirrel does not find good shelter and sufficient food. It does not nest here and stays only on its way to other more suitable places.

5. The squirrel does not occur in pine marshes with large peat bogs covered with small pines and birches. I. D. Kiris saw a squirrel only once in this habitat.

6. Birch groves within other forests supply good shelter in the form of dense coniferous underbrush of stone pine, fir, pine or spruce. The food supply in such a habitat is poor and squirrel nests are therefore absent. The squirrel does not usually stay long in birch forests. However, it molts in denser parts of the birch forests, as they give good shelter. Squirrels are found in birch forests during migrations.

In western Siberia the preferred habitat of Sciurus vulgaris exalbidus is pine forests on the right bank of the Ob, between Biisk and Novosibirsk, and pine forests from the Ob to the Irtysh, across the Kulundinsk Steppe. These pine forests are of a humid type. They grow on sand dunes. Professor V. V. Reverdatto (1931) describes such a forest, the Verkhneobskii Pine Forest: "This enormous forest has a high moisture retention. Many streams therefore originate in it and there are several large lakes like the Bol'shoe Kamyshnoe, etc. The boreal character of 350 this forest, including the presence of peat bogs caused by the high rainfall produced sandy podzolic soils (as these forests grow on sand dunes deposited by the Ob river). Large areas are occupied by Pinetum vaccinosum and other forest associations such as Pinetum herbosum (grassy pine forest), Pinetum hylocomiosum (mossy pine forest), etc. The grass cover and the vegetation of the marshes have a definite northern character.

The only other coniferous tree in the Verkhneobskii pine forest is larch (rare). There are many lakes of various sizes in the Ozerskii forest.

The "ribbon" pine forests between the Ob and the Irtysh (on the left bank of the Ob) are restricted to upper quaternary sand in depressions along rivers. These ribbons run from the northeast to the southwest. Most of these pine forests are narrow strips, about 15 km wide and 106 km (Burlin and Kulundin forests) to 213 km long (Kasmalin and Barnaul forests). These lie lower than the steppe areas between them. In the monograph "The Teleut Squirrel" (Belki-teleutki*, 1935), G.K. Gol'tsmaier distinguishes the following types of ribbon pine forests: 1) green-moss pine forest; 2) dry-lichen pine forest; 3) grassy-steppe pine forest.

FIGURE 173. A squirrel running on a branch

Drawing by A. N. Formozov

351 The Srostino forest is the southernmost of the so-called "central group", northwest of Rubtsovsk. Gol'tsmaier describes it as follows: "There is no running water in the Srostinsk forest. Lakes and marshes named "sogr" constitute the only water bodies. They lie in deep depressions between sand banks and are overgrown with vegetation. Free water surfaces are found in the deeper parts of the marshes. The shallow parts of the marshes are covered with an impenetrable thicket of cattail, cane, bulrushes, sedge and other marsh plants. Their rhizomes form a shifting cover on the water. The marsh is surrounded by a wall of cane or bulrushes which is replaced on the outside by a ring of willow (Salix cinerea L.) on a layer of thick moss, overgrown with reeds (Phragmites communis Trin.) and some grasses. Higher up, the willows are replaced by dense aspen and birch underbrush. The soil is completely covered with fallen leaves, and the grass cover is sparse. Further inland the ring of deciduous trees is replaced by dense young pine forest (40 years old or less). The ground is

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* [Teleut squirrel = Sciurus vulgaris exalbidus Pall.]

covered here by the leaves of the deciduous trees, pine needles and peat moss. The grass cover is dense, including also Solidago virga aurea L., Artemisia campestris forma glabra, Hypochoeris maculata L., Pyrola sp. Yellow acacia trees form underbrush in some places. Higher up, the trees surrounding the marsh are replaced by old pine forests with thin grass cover in which Festuca ovina L. predominates. A few of the following plants also occur among the grass: Alyssum desertorum Statt., Artemisia campestris forma glabra, Koeleria glauca D.C., Melandrum album Larcke, Euphorebia esula L., Pulsatilla patens Mil., Stipa ioannis Czelak., Allium nutans L., Phragmites communis Trin., Solidago virga aurea L., Silene volgensis Bess., S. chlorantha Ehrh., Phleum boehmeri Wibel, Scabiosa ochroleuca L., Hypochoeris maculata L., Equisetum hiemale L., etc.

"The grass cover is thin, and the soil is visible everywhere, barely covered with pine needles and cones. In some places, mainly in the small depressions, there are small green shoots, pine underbrush, and lichen. 352 Yellow acacia bushes are rare, small aspens even rarer... The higher ground is occupied by steppe pine forests."

This form of pine forests produces well developed forest margins around marshes and clearings which occupy about 25% of the area of the pine forest. Trees growing in them give better crops. Forest borders are the most suitable habitat of squirrels, as food is more plentiful in them than in other parts of the forest.

According to K.A. Zabelin, in East Siberia, e.g., in the Barguzin forest of Transbaikalia, squirrels occur along the shore of Lake Baikal and high in the mountains near the limit of vegetation. Although squirrels may live in various types of forest, they prefer dry, high and dark pine forests. Depending on the supply of cones, squirrels occur either in cedar, pine or larch forests.

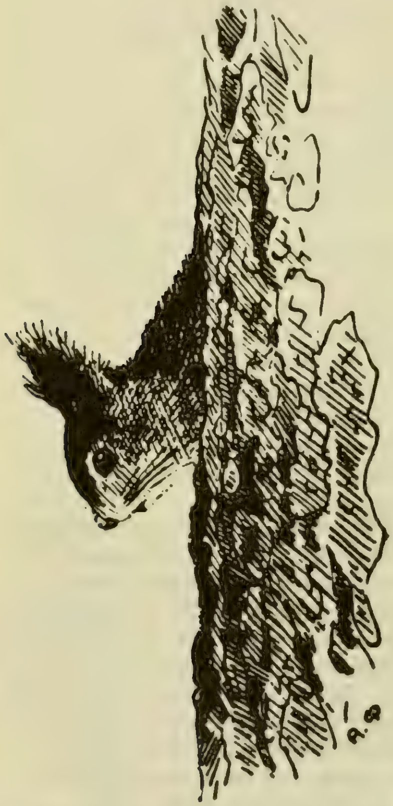

FIGURE 174. Squirrel looking out from behind a tree

Drawing by A.N. Formozov

According to G.N. Gassovskii (1927), in the Gilyui-Oldoi District (East Siberia) squirrels occur in mixed, coniferous or in deciduous forests, in broad river valleys and at the limit of mountain forests in thickets of creeping cedar underbrush. They are especially numerous in coniferous forests, mainly in Jeddo spruce forests along streams and brooks, and in pure pine forests on terraces above rivers, on mountains and dry, steep slopes. Squirrels rarely occur in pure larch forest. G.N. Gassovskii states that the occurrence of squirrels in different habitats depends on the food supply: cones of larch, spruce or cedars, and the mushrooms in deciduous forests.

Although the squirrel typically inhabits the forest, it also occurs exceptionally in the dwarf forest or tundra shrubs. This is due to migrations (see below).

The squirrel is well adapted to arboreal life. Its soles are padded and its toes have sharp, curved claws which enable it to grasp branches firmly. Its movements are elegant and rapid. It climbs trees quickly, its tail outstretched. It maintains its balance well, even on thin, moving branches, by lowering or raising its tail. It is able to perform great leaps. It leaps 2-3 m or more. Its leaps are especially long when it jumps downwards (Figure 175); when it jumps from a tree to the ground it may cover 15 m. When a squirrel sitting on the ground is frightened, it gives a sudden squeak, rapidly running up a tree. When threatened it hides by pressing
353 itself tightly to a branch or conceals itself among the dense branches.

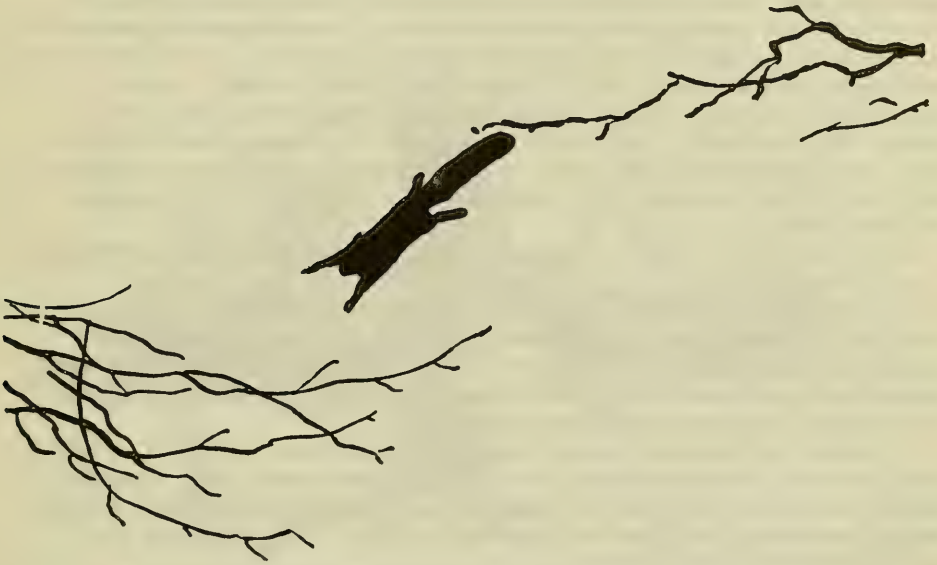

FIGURE 175. A squirrel leaping from one branch to another

Drawing by A. N. Formozov

When resting, the squirrel sprawls against a branch, extends tail and legs and basks in the sun.

In winter, it either moves from one tree to another, or more rarely moves on the snow, depending on the weather. When snow hangs from the branches the squirrel often has to move on the ground, because when it lands on the branches it cannot grasp them owing to the crumbling snow. When the branches are free of snow, the squirrel prefers to remain above. It always moves in the trees when going to the nest. Where squirrels are little persecuted, they let man approach. Young squirrels are also very trusting. When man appears, the squirrel shows a keen curiosity. It settles on a branch, raises and lowers its tail, swings and leans forward, giving its typical squeak. When it is frightened it rapidly climbs to the top of a tree, stops on a branch, and continues to scrutinize man.

The usual voice of the squirrel is a typical quick squeak. To express joy it may emit a soft whistle. The plaintive cry of a wounded squirrel resembles that of a wounded hare.

Squirrels can swim for a long time. Migrating squirrels swim across broad rivers like the Ob and Yenisei. A.K. Zabelin states that squirrels
354 occasionally swim across the Chivyrkui Inlet of Lake Baikal which is 10-12 km broad in some places. While swimming the squirrel holds its tail inclined and raised above the water. The tail of the exhausted animal drops and becomes submerged.

The squirrel is a diurnal animal. Its daily life begins soon after sunrise. In July active squirrels may be seen as early as 5 a.m. After leaving the nest, the animal plays, climbs on trees, runs on the ground and is very active. It then begins feeding. If it becomes tired it may take a short nap. It rolls itself into a ball on a branch, tucks its head under its body, and covers itself with its tail. In summer, during the midday heat squirrels take shelter in their principal or auxiliary nests. They sleep rolled up, waiting until the heat subsides. They appear again when the afternoon becomes cooler, and continue their activity. They return to their nests before sunset. G.K. Gol'tsmaier (1935) writes: "After separating from their mother, young squirrels spend the night in any shelter they may find or on a thick branch, as they have no nests of their own. On 9 September 1930, early in the morning, I found a young squirrel which has spent the night in the upper third of a high pine, on branches near the trunk."

G.K. Gol'tsmaier thinks that the Teleut squirrels sleep about 7-8 hours a night in summer.

The type of food in a locality influences the daily activity. A.N. Formozov (1934) writes: " Squirrels in spruce and pine forests spend almost the whole day extracting seeds from the cones. On the other hand, squirrels in oak forests still their hunger with 3 or 4 acorns. In winter they sleep in their nest soon after sunrise."

In autumn, as the days become shorter, the animals come out of the nest later and return earlier in the evening. The midday rest becomes shorter and finally is given up completely. Morning and afternoon feeding periods become united into one period of activity. This is typical for late autumn and winter activity.

The short summer rains apparently do not affect the daily activity of the squirrel. When it is surprised by rain, it waits in a shelter for good weather, but it may sometimes ignore bad weather. I frequently saw squirrels active during rain. Rain in autumn and continuous rain followed by snow usually drive the squirrel into its nest, or into shelter among branches.

Snowstorms in winter certainly affect the squirrel. The animal then sits in its shelter and does not come outside. G.K. Gol'tsmaier writes: "On 18 November 1931, my assistant Smakotnin found a squirrel nest during a snowstorm. Attempting to drive the squirrel from
355 the nest he began shooting over the nest and shaking the tree, but in vain — the animal did not appear. He therefore thought that the nest was empty, pushed it off with a pole and brought it to the sledge. Only then did a squirrel jump out, and Smakotnin caught it. It was a healthy female which

we kept a long time in captivity. Its reluctance to leave the nest was certainly not due to injury or disease." Golts'maier observed that severe frosts do not influence the daily activity of the squirrels. He saw, for instance, squirrels leaving their nest at temperatures between -30° and -42°. This severe frost occurred in clear and calm weather, without snow.

N. P. Naumov (1930) observed the following: "Near the Stony and Lower Tunguska, the squirrel is active in the first half of winter. It comes out of the nest in the morning. It does not feed on its food reserves, but digs deep under the snow to feed on what it can find. When the snow covers the ground in a thick layer and hangs heavy on the branches, it hinders the animal's climbing. There is nearly no wind in this season... The appearance of large lumps of snow on the branches is followed by true arctic frosts (-50° to -60°). The squirrel is therefore forced to remain in its nest from the second half of December, leaving it only on warm days to feed a little."

In the central part of the European U.S.S.R. squirrel nests are mainly found on spruce. M.P. Raspopov and Yu. A. Isakov (1935) give a detailed description of squirrel nests in the Moscow region.

They examined 128 nests. Of these 119 were on spruce, 7 on pine, 1 on birch and 1 on larch.

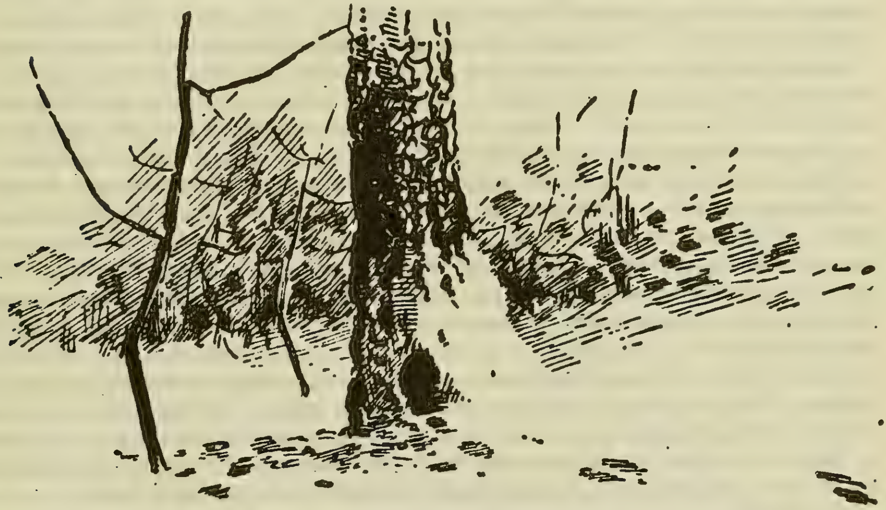

FIGURE 176. Squirrel tracks in the snow near a hollow with a store of nuts
Drawing by A. N. Formozov

356 The squirrel generally builds its nest near the trunk, usually at the fork of two or three branches. The nest is rarely built in the middle or at the end of branches of trees which stand close together. In the Moscow region nests are built on trees 15 - 30 cm thick. They are usually 5-15 m above the ground. Nests on pine trees are usually higher up than on spruce. This may be due to the fact that the stem of pine trees is without branches to a greater height. The nest has therefore to be built in the dense upper part of the tree. Raspopov and Isakov (1935) observed that in the center of the forest nests are built higher up than at the border, because trees grow higher in the center than at the border.

The measurements of the nests of Moscow squirrels are as follows: length 20-50 cm (generally 35-40 cm); width 25-50 cm (generally about 35 cm); height 20-40 cm (generally about 30 cm). Average weight of a dry, inhabited nest about 450 g.

These figures show that the nest is generally spherical. The inner space is 12-16 cm wide. The entrance to the nest is round and is about 5-6 cm wide (rarely 8 cm). The entrance is strictly orientated. Nearly all entrances in the Moscow region are facing south, southeast or east. This is most probably due to the prevalence of cold northwestern and humid western winds.

Raspopov and Isakov (1935) give the following table:

Entrance Facing	NW	W	SW	S	SE	E
Number of nests	1	4	8	27	34	52

The outer layer of the nest consists of branches of the tree on which it is built. Branches of other trees are used rarely, when a different tree grows close to the tree on which the nest is built.

In the Moscow Region, the inside of the nest is lined with soft material: moss, lichen, dry grass, bark and leaves of birch, oak, aspen, etc., occasionally feathers and fur of the squirrel. The preferred lining is apparently bark. It is used even when enough moss and grass are available. The squirrel strips the bark in an original way. It bites off the tip of a twig and, holding it with its teeth, descends along the trunk, peeling the bark until it tears off. Raspopov and Isakov observed that the animal takes the strips of bark into its mouth in loops and carries them to the nest.

Inhabited nests are of two types: the nests of the females are larger and better built than those of the males. The males usually build their
357 nests in abandoned nests of females or on abandoned nests of thrushes, magpies and sparrow hawks. The nest is built as follows: The squirrel first makes the bottom by interweaving slender and flexible twigs between two branches, as support. Then it builds the sides. The top is made of strong branches. The nest is reinforced by interwoven twigs. After completing the frame, the squirrel begins collecting material for the inner lining. The building of the nest takes 3 to 5 days. As the nest of the male is built on an existing nest, its building and repair takes only 1 to 2 days.

One often finds abandoned and unfinished nests. The squirrel ceases to build when frightened. It also may abandon a nest if disturbed.

In the Moscow Region squirrels often nest in hollows in trees, and even in starling boxes.

A.A. Migulin (1924) observed that the Ukrainian squirrel occasionally builds its nest on oak trees, using slender twigs from the top together with pine twigs. It lines its nest with moss.

G.K. Gol'tsmaier (1935) gives the following description of the building of the nest of the Teleut squirrel: "The squirrel uses different materials found in the vicinity. The solid external frame of the nest is usually made of pine twigs, which are so firmly interwoven that it is almost impossible to pull out one twig without dislodging the rest or breaking the nest. It appears from the crumpled pine needles and broken twigs that this firmness is not attained without effort. . . The outer frame covers the inner, soft part and protects it against injury. The inner lining of the nest is made of moss, lichen of the genus Cladonia, dry grass, dry leaves (mainly of aspen), bark of birch or willow, fur of hares which is commonly found in forests because of the capture of hares with nooses, tufts of reed and feathers... The inner layer of the nest on which the squirrel rests is carefully plucked, so that it is always soft.

"The nest is usually spherical, sometimes ovoid. Its outer measurements are as follows: length 50 cm; width 30 cm; height 35 cm; circumference 100 cm. The cavity of the nest is small as the walls are very thick. The inner measurements are as follows: length 20 cm; width and height 10 cm. The length of the cavity is not always in the same direction as the outer length, but sometimes lies in the short axis of the next. Every nest has two exits. The openings are small, and their width (about 5 cm) is adapted to the size of the squirrel. Each entrance is carefully concealed by dry grass, moss, etc.

"The Teleut squirrel usually builds its nest on pine and only rarely on other trees...

358 "The Teleut squirrel chooses different habitats for its nests. In the Srostinsk pine forest, about 50 % of all nests found were in young forests, 30 % in clearings and 20 % in other forest. The proximity to water is a decisive factor in the choice of a nesting site in this pine forest. V. V. Gubar' observed that in the Upper Ob pine forest most of the nests are built on high trees or in clearings. Proximity of water is apparently not important in this forest, as there are many marshes, lakes and rivers.

"Nests are always built in the upper part of the tree, at a height of 3.5 to 20 m and higher... We once found a nest in a hollow the entrance of which was only 2.5 m above the ground.

"We heard from local hunters that nests may occasionally be found in unusual places, e.g., hollows in felled trees. A hunter from the village Srostino stated that he caught two squirrels in a nest on the bank of the Sorga, under broken reeds covered with snow...

"Each female has several nests which it uses at the same time. Each nest may be used as principal and the others as auxiliary nests. The principal nest is built last. In winter it is used as a resting place and as a dwelling at night. In summer the young are kept in it. The squirrel uses the auxiliary nests only rarely in winter to spend the night and to rest. In summer it sleeps in them at night, visiting the principal nest only to feed the young. If the principal nest is destroyed the squirrel moves to the auxiliary nests until a new principal nest is built. If the principal nest is found, it is easy to observe activities of the squirrel...

"There are many reasons for the possession of a number of nests by one squirrel. Some of them are possibly taken over from squirrels which have been killed. However, most of them are built by the squirrel itself, so that it can transfer its young to a new shelter in an emergency... The squirrel also probably builds a new nest before giving birth, in order to rear its young.

"Nests of males and females are indistinguishable.* During the rut, the male apparently loses connection with its territory and nests. He uses the nests of the female in her territory. The male generally devotes less time to nest building than does the female. This is supported by the fact that in summer, the male may rest in old nests of crows."

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* This differs from the observations of M. P. Raspopov and Yu. A. Isakov, quoted above, on squirrels of the Moscow Region.

In addition to residential nests, the squirrel also builds so-called "shade nests".

G.K. Gol'tsmaier writes: "Shade nests differ from residential nests in the absence of a soft inner lining; they consist only of an outer frame. They are not as solidly built as residential nests. The squirrel occupies
359 them when it eats pine cones. The shade nests therefore always contain remnants of food. As they are built only in summer, their purpose is probably to protect the squirrel from the heat of the sun, against which the pine needles give little protection. The shade nests also presumably hide the squirrel from birds of prey, while it feeds."

According to K.A. Zabelin (1926), squirrels do not build their nests in birds' nests in the Transbaikal forests. The author explains this by the fact that there are no magpies in Podlemor'e*, and the crows nest in places where there are no squirrels**. "When the nest has no roof, it is usually covered by cedar branches. In this case it resembles a crow's nest. Such nests are apparently used by the squirrel only in summer. In winter it builds a more solid nest. The winter nest has a dome-shaped roof made of interwoven twigs. It is generally spherical and closed from all sides. It is of the same size as the summer nest."

According to G.N. Gassovskii (1927), in the Gilyui-Oldoi hunting territory (Far East) squirrels nest close to sources, mainly in spruce groves common in the Gilyui-Oldoi Territory. However, squirrel nests are also often found in pine groves.

Squirrels rarely move far outside their territory. S.I. Orlov (1930) reports that squirrels entered the tundra, and also that squirrel nests were found in alder groves along the Pura river. Frozen squirrels were found in these nests in spring.

FOOD OF THE SQUIRREL. S.V. Lobachev (1932) examined the stomach content of squirrels in the Verkhnevychegod District. He found that it consisted mainly of coniferous seeds of the tree species in the forest in which the animal was caught. In the absence of other food the squirrel may eat the bark of trees, e.g., birch bark. Such a diet causes rapid emaciation, and reduction of fat and weight.

M.P. Raspopov and Yu.A. Isakov (1935) made interesting observations on the diet of the squirrel in nature. They examined the contents of tree hollows in the park of the Agricultural Academy (near Moscow), and found the following: 1) 650 acorns in a hollow in a linden tree 3.60 m above ground; the hollow was 40 cm deep; 2) 214 acorns in a hollow in a poplar, 6 m above ground (hollow 25 cm deep). All acorns were fresh and none were spoiled. From 30 September onwards the authors observed that squirrels stored Boletus luteus in the vicinity of the Petushki station of the Gorki Railway. They placed the mushrooms into forks at the end of branches and near the stem. Squirrels often eat buds of spruce which are covered by a
360 membranous cap (especially in early spring). At this time one finds trifurcate spruce branches in the snow under the trees. I frequently found them in forests near Zagorsk (Moscow Region). Similar observations were made by Raspopov and Isakov.

Squirrels can smell spruce cones buried under 30 cm of snow. The crossbills break off large numbers of cones and throw them to the ground.

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* [Area near Lake Baikal.]

** Squirrels often use nests of other birds. For example, in the central part of the European U.S.S.R. they may be found in nests of thrushes, jays, etc.

These cones contain many seeds which have not been eaten. The seeds are preserved under the snow until summer. This supplies food for the squirrels during the time when the new cone crop is poor and only cones from the previous crop are left over.

M. P. Raspopov and Yu. A. Isakov record that squirrels eat Planorbis corneus and Vivipara contecta as secondary foods. Squirrels were seen to catch the snails on thawed patches near the pond of the Agricultural Academy. Pieces of shells were found in starling boxes.

Observations and experiments on the food of squirrels in captivity are important for the study of its diet. Such studies were carried out by M. P. Raspopov and Yu. A. Isakov (1935) in the Moscow Zoological Garden. They found that squirrels were particularly fond of walnuts, spruce cones and buds, pine buds, oats, hemp, apples, Armillaria mushrooms, etc. They also ate pine and hazel nuts, acorns, fresh or dry bilberries, pears, carrots, lettuce, wheat, peas, lentils, etc., but less avidly. The preference for the above foods varied with the seasons. In autumn the squirrels accepted hazelnuts, walnuts and pine nuts. In spring they preferred carrots, apples and other vegetables and fruits.

V. G. Stakhrovskii (1932) studied the food of squirrels in open-air cages. He determined which mushrooms the squirrels eat, and their preference for each species. They eat and store Cantharellus cibarius, Boletus edulis, Boletus rufus, Boletus scaber, Pholiota mutabilis, Colocera viscosa, Armillaria mellea, Lactarius torminosus, Boletus luteus, Boletus subtomentosus, and more rarely, Psalliota campestris. Squirrels refuse the following mushrooms: Hypholoma fasciculare, Hydnum repandum, Lactarius vellerus, Amanita phalloides, Coprinus ephemerus, Coprinus fuscescens.

Stakhrovskii also studied the preference of squirrels for berries. They are indifferent to honeysuckle, cherry, gooseberry, buckthorn, elder, European bird cherry, lily of the valley, wild rose, spindle tree. They eat little or reluctantly: raspberry, bilberry, Alpine bilberry. They sometimes eat European mountain ash, cranberries, red bilberries, bramble and juniper berries.

361 Valuable information on the food of the Teleut squirrel is given in the work of G. K. Gol'tsmaier (1935). He came to the conclusion that the most important food of the Teleut squirrel is pine nuts and mushrooms. The squirrel begins feeding on pine nuts in early July, and eats different numbers of pine cones per day depending on the season. G. K. Gol'tsmaier observed that the greatest number an animal may eat in 24 hours is 190 pine cones. The average weight of one pine nut is 8.45 mg, and a cone contains 10 full seeds on the average. The animal therefore may consume 16.1 g of dry pine nuts per day. M. P. Raspopov and Yu. A. Isakov made similar studies of the Moscow squirrel. They found that the squirrel consumes about 55 g of food per day in summer, 70 g in autumn, 35 g in winter and 80 g in spring.

The Teleut squirrel does not open pine cones the seeds of which are empty or infested by insects. It is apparently guided by its smell.

The Teleut squirrel begins to feed on mushrooms in late summer. In autumn its diet consists mainly of fresh mushrooms and pine nuts. During this period it begins to store mushrooms for the winter. Gol'tsmaier found the first dried mushrooms (Boletus luteus) in early August which had apparently been collected in late July.

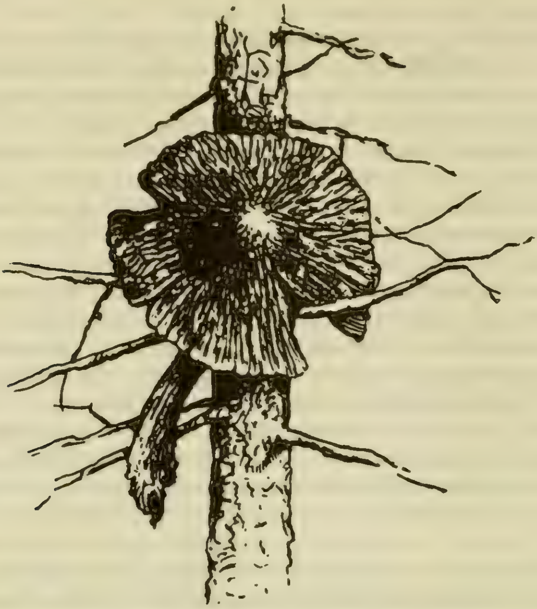

FIGURE 177. A mushroom stored by a squirrel
Drawing by A. N. Formozov

Gol'tsmaier writes: "The Teleut squirrel collects mushrooms with stems. It carefully carries one in its teeth to the nearest tree, where it pushes in into a fork of two branches or between the stem and a branch. The mushroom is arranged so that its pileus lies above two branches or hangs down from them. When it is dry it shrinks and surrounds the branch. It is so firmly fixed that neither wind nor shaking makes it fall... Most mushrooms are stored on pine trees, as these are most numerous. A smaller number is found on birch, aspen, willow and yellow acacia... The 362 squirrel chooses forks from 30 cm to 4 m high for this. Mushrooms stored low down are later buried by snow. However, they are not lost and the squirrel digs them out from the snow."

With the onset of severe frosts the squirrel feeds almost exclusively on mushrooms. This gives it sufficient food in a short time so that it does not need to climb trees to search for pine cones. Gol'tsmaier observed that the Teleut squirrel feeds on the following mushrooms: Boletus scaber, B. rufus, Boletus luteus, B. bovinus, B. subtomentosus, Boletus chrysenthereon, B. piperatus, Pluteus nana, Clitocyle sp., Pholiota sp., Gomphidius glutionosus, Ganoderma sp.

Gol'tsmaier writes: "The squirrel prefers different mushrooms in different years. In 1930 most of the stored mushrooms consisted of Boletus luteus, B. scaber and B. rufus, and other species were poorly represented. On the other hand, only a few Boletus scaber and B. rufus appeared in stores in 1931. Instead there were Gomphidius glutionosus, Boletus luteus and B. bovinus. The favorite mushroom in this year was Boletus luteus. This may be deduced from the fact that this was the first mushroom to be eaten from the food stores."

The squirrel removes the dried mushroom from the branch, holds it between its forefeet and rapidly eats it, turning it between its feet. It often eats only the pileus, throwing the stem away. Gol'tsmaier did not observe how the squirrel eats fresh mushrooms on the ground. To judge by tooth marks it seems that the animal does not pluck the mushroom but begins to eat it from the pileus.

According to Gol'tsmaier, the Teleut squirrel eats large numbers of dry mushrooms daily, as many as 35.

The diet of the Teleut squirrel also includes other vegetable foods. Animal foods are less common. Squirrels were found to eat the following: sawfly larvae, ant eggs (cocoons), butterflies, flies. Only once did Gol'tsmaier find remains of a Lacerta agilis in the stomach of a squirrel.

According to E. V. Kozlova-Pushkareva (1933), squirrels of the Hentey Range (Northern Mongolia) stored bones of the skull of roe deer for the winter. They put the bones on thick branches near the stem of the trees. Bones are rich in ash. These stores of bones were made by squirrels in years with rich cedar crops. It should be mentioned in this connection that in German forests squirrels were found to gnaw the shed horns of ungulates (Rimand, 1928). Rimand reports that squirrels gather in permanent resting places of roe deer (cf. V.N. Kaverznev, "Squirrels and Squirrel Hunting" (Belka i belichii promysel), Moscow 1931, p. 28).

363 In captivity the squirrel may attack large birds. Gol'tsmaier writes: "On 1 August 1931 we liberated a wounded jay (Garrulus infaustus) into a cage of squirrels. The bird was immediately caught by a young male squirrel who broke its skull and ate its brain."

Gol'tsmaier made the following table of the food of the Teleut squirrel in various months.

Months	Type of food
January	Mushrooms, pine nuts
February	Mushrooms, pine nuts
March	Mushrooms, pine nuts
April	Mushrooms, pine nuts
May	Mushrooms, pine pollen, animal food, rarely pine nuts
June	Mushrooms, pine nuts, ant cocoons and other animal food
July	Mushrooms, pine nuts, ant cocoons, sawfly larvae and other animal food
August	Mushrooms, pine nuts, ant cocoons, sawfly larvae and other animal foods tree leaves
September	Mushrooms, pine nuts, sawfly larvae and other animal food
October	Mushrooms, pine nuts and other vegetable food, ant cocoons, insect larvae
November	Mushrooms, nuts, aspen buds and other vegetable foods, sawfly larvae and other animal foods.
December	Mushrooms, pine nuts, sawfly larvae

The squirrel needs water. Observations of this animal in captivity show that it drinks much. In dry years the squirrel keeps close to water in the forest. In winter it may satisfy its thirst with snow.

Thus to summarize the data on food of the squirrel: In coniferous forest, the main food is coniferous seeds.[*] In the oak and nut tree forests, acorns and nuts are the main food. For European and most Siberian squirrels mushrooms are a secondary food in years with plenty of cones and other basic foods. In years with small crops of tree seeds, the squirrel feeds on mushrooms, berries, buds and also animal foods. As described above, the Teleut squirrel eats large numbers of mushrooms. This is due to the poor flora of the pine forests, which gives only a limited choice of food, mainly mushrooms and pine nuts.

364 The food of the squirrel may change sharply under certain conditions. K. Plyater-Plokhotskii ("Vestnik Dal'ne-vostochnogo filiala Akademii Nauk", 1935) reports that large numbers of squirrels migrated from forests of the Far Eastern taiga to fields of corn and sunflower because of the failure of the crop of pine nuts in 1935, Great damage was caused to the plantations. The damage caused to corn by the squirrel is typical. It climbs on the plant, tears off the leaves enveloping the cob and plucks the seed with its incisors. It opens it, eats the germ and discards the rest.

Detailed work has recently been published on methods of determination of age and length of life of squirrels. We have quoted the work of M.K. Serebrennikov (1930) and N.P. Naumov (1934) on changes in skull and teeth of squirrels. Naumov also studied the structure of the claws. He studied: 1) the number of grooves on the surface of the claw; 2) the number of tubules in the deep stratum (between the superficial and the sterile stratum) from the germinal matrix in the last phalanx to the tip of the claw. These tubules (called "Ausfüllungshorn" by German authors) are easily seen with a magnifying glass through the surface layer of the claw.

There is no need for histological sections, like in the study of bone. It was found that the number of grooves on the claw[**] (at its base and on its sides) increases regularly with age. One new groove is added each year. The older grooves lie near the tip of the claw, the younger grooves near its base. Examination of a large amount of material showed that there are deviations. There is sometimes a correlation between the number of grooves and the age of the animal, but in other cases there is no correlation. Claws of old specimens frequently have not enough grooves. This may be caused by the disappearance of grooves through abrasion.

Analysis of the number of tubules of the deep stratum did not give clear results. The growth of layers of tubules with age could not be exactly determined. These characters should therefore be used with caution and only as control of more reliable characters like structure of teeth and skull.

As shown above the age of a squirrel can be more or less exactly
365 determined by the rate of abrasion of the teeth. There occur very old specimens (8-9 years). The length of life of the squirrel is determined differently by different authors. Korschelt[†] claims that the life of the

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[*] A list of important trees in Russian forests: Picea excelsa Link, P. obovata Ledebour, P. jezoensis Carr., Abies sibirica Ledeb, A. nephrolepis Maxim., Larix sibirica Led., L. gmelini, Pinus, Pinus sibirica Mayr., Pinus pumila (Pall.) Rgl., Pinus koraiensis Sieb. et Zucc., Quercus petraea, Q. robur L., Q. mongolica Fischer, Corylus avellana L., Juglans mandshurica Max, and others. The seeds of these trees are eaten by the squirrel.

[**] The grooves are studied with a magnifying glass with a magnification of 10 to 15×. The claw is illuminated from different directions.

[†] Korschelt, Lebensdauer, Alter und Tod, Jena, 1924.

squirrel may last 10-11 years. S.A. Severtsov* thinks that its length of life is 12 years.

According to N.P. Naumov (1934), only 20-25% of the new generation live to the age of one year. There is thus a very high mortality among the young: 10-15% reach the age of 2 years; 3-5% — 3 years; 1-2% — 4 years; 1-0.5% — 5 years.

Where squirrels are hunted regularly the percentage of animals reaching the age of one year and reproducing is lower than that in regions where the animal is hunted irregularly.

N.P. Naumov states that old, experienced squirrels have many advantages over the young in regions with irregular hunting; they are more able to hide from their principal enemies. They also stand periods of food scarcity better than do the young, because of their experience, their stores of food, etc. Where huskies are used for hunting, the squirrels are found by traces of their activity and animals of any age or sex may be caught. The experience of the old squirrel is of no avail against the dogs. An equal number of young and old specimens are killed. This eliminates the selection in a natural environment, without the activity of man. The chances of a squirrel reaching old age are therefore very small in hunting territories, and its life is shorter by 2-3 years. Adults which live through the winter are 1 to 6 years old and are in their prime. Where squirrels are not hunted, about 25% of the adult population is senile. The females of this group are probably sterile or remain unfertilized as they mate with very old males. This reduces the number of young (N.P. Naumov). He writes: "We assume that the large number of senile, sterile specimens causes a reduction of the reproduction rate and decreases the percentage of young. However, when natural selection is replaced by hunting, the population is rejuvenated and the reproduction rate increases."

Where hunting is intensive, each pair has about 9 young, while pairs in unexploited territories produce only 4 young (N.P. Naumov).

366 According to Gol'tsmaier male Teleut squirrels are more numerous than the females. Of 249 specimens obtained, 56%, were males and 44% females. Of the newborn 62% are males, and only 38% females. This difference disappears later and the sex ratio becomes about 1:1. According to S.V. Lobachev (1932), 49% of the squirrel population were males and 51% females. The sex ratio was thus 1:1. N.P. Naumov (1934) analyzed squirrel populations and found that the sex ratio is about 1:1, with slight prevalence of males.

Most observations show that there are two periods of rut. This, however, varies with the locality. For example, in the southern and central parts of Russia there are three periods of reproduction (N.P. Raspopov and Yu.A. Isakov, 1935). In the north the squirrels have two litters or even only one per year. Females have estrus at different periods, according to the locality. According to L.P. Sabaneev, estrus begins in late February in the Moscow Region (10-25 January according to more recent observations by M.P. Raspopov and Yu.A. Isakov). In the Upper Vychegda area estrus begins in early February (S.V. Lobachev, 1932). In the northern part of the Tobol area it begins in the middle of March (Dunin-Gorkavich, 1908). In the Ket area of the Narym Territory it begins in late March (Afanas'ev,

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* S.A. Severtsov, "The Relation between Length of Life and Fertility in Various Mammals" (O vzaimootnoshenii mezhdu prodolzhitel'nost'yu zhizni i plodovitost'yu raznykh vidov mlekopitayushchikh). — Izvestiya Akademii Nauk SSSR, 1930.

1928) and in the Tara District in early March (V.E. Ushakov, 1927). In the Turukhansk Territory it begins in late February or March (M.F. Krivoshapkin, 1865; P. Tret'yakov, 1869); in the Angara area in the middle of February (V.N. Troitskii, 1930); in the Barguzin Territory in late January or February (K.A. Zabelin, 1926); in the Anadyr Territory in the middle of February (N. Sokol'nikov, 1927).

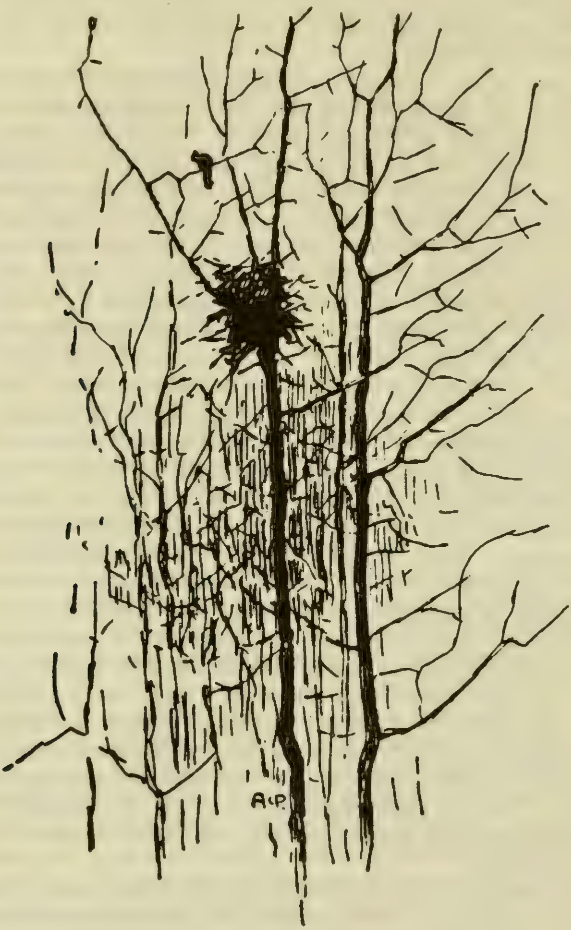

FIGURE 178. A squirrel nest
Drawing by A.N. Formozov

367 Weather certainly affects the onset of estrus. Late spring and frosts delay the rut, and good weather hastens it. The physical condition of the animal and its food also affect the rut. In emaciated animals, estrus is delayed and prolonged. This results in many barren females. In years with much food in autumn the animals are well nourished, and the spring rut appears early.

In Siberia strong snowfall and snow on the trees inhibit the activity of the squirrels. N.P. Naumov writes: "The squirrel shows little activity in winter. It spends the severe frosts in semihibernation. This is followed by a period of increased activity caused by strong winds. These winds, which come rarely in late January, usually in middle or late February, blow the thick snow (which hinders the movements of the squirrel) from the branches. The snow may be 5-10 cm thick on the branches, especially in the region of the Siberian anticyclone where there is little wind in winter. The snow often covers the cones. Observations in the Turukhansk Territory (winter 1927-1928) showed that heavy snow on the trees and late appearance of winds forced the squirrels to stay in their nests to the middle of February although the temperature was favorable."

During the rut the males chase the females in groups of four to six. They often fight for a female. The battlefields of males consist of large areas of snow covered with tracks. The males are very excited, run about, squeak, jerk their tail up and down, chase females and fight. They also joggle their jaws, grinding their teeth, and often give high-pitched squeaks like the mewing of a cat. They smell and lick the female's urine on the snow.

The chase takes place on the ground and on the trees. When a group of squirrels is chased by a dog, it settles on a tree. The female nearly always stays below the males which sit higher up among the branches, move their feet up and down and patter.

In the first estrus in early spring or in late winter the estrus of old females appears earlier than that of young females, which breed for the first time. That females are chased by several males may be explained by the fact that sexual excitement appears earlier in males. This creates a temporary surplus of males. The chase itself usually takes place in the morning beginning shortly before sunrise and ending towards noon. It often begins again towards evening. M. P. Raspopov and Yu. A. Isakov made observations on the copulation of squirrels. After an energetic sex play the male leaps onto the female, who rises on her legs, folds her ears backwards and turns her tail sideways. The male clasps her flanks near the hind legs with his forefeet, holds her with his muzzle and copulates. Copulation is accompanied by loud grumbles and squeaks of the male and by
368 complete silence of the female. Copulation lasts about 15 minutes. At the end the male grows weak and hangs helplessly on the female. Blood oozes from the genitals of the female after the first copulation. The male covers the female about eight times during the day. Fertilization probably takes place when the exhausted male hangs on the female. It was observed in the Zoological Garden that squirrels rub their genitals against the snow and lick the penis after copulation.

Estrus lasts about 2 weeks. The female lets the males copulate during 3-4 days, towards the end of the rut. During the other days she runs away or drives the males away.

Recent observations show that the gestation of the squirrel lasts 35-40 days.

The second rut begins at different periods after the first. Its appearance is influenced by a good food supply. Poor physical condition and little food retard the appearance of the second rut.

V. G. Stakhrovskii (1932) states that the second rut begins 36-37 days after the birth of the first litter. The young open their eyes at about this period. S. V. Lobachev (1932) observed during the Upper Vychegda expedition that the second rut begins when the young of the first litter become independent in the middle of June. The data of Gol'tsmaier (1935) confirms Lobachev's data. N. P. Naumov (1934) thinks that in years with poor food

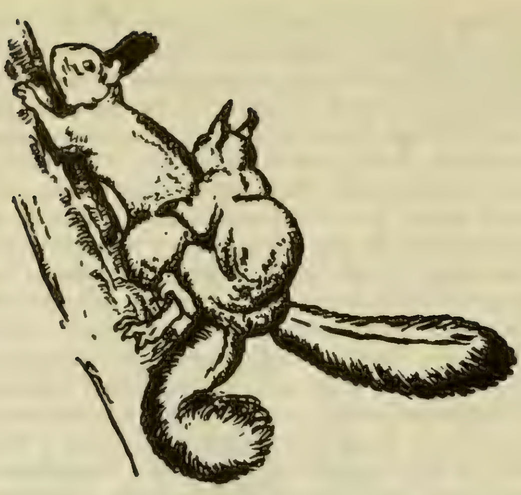

FIGURE 179. Copulation of squirrels
Drawing by V. A. Vatagin

supply the birth of the first litter is separated from the second estrus by the nursing period of the young, 70-75 days. In years with a good food supply this is reduced to 50-55 days. A.N. Formozov made observations in the Krasnye Baki District of the Gorki Region, in summer 1932. This summer was preceded by a year with a rich yield of spruce nuts. On 3 July 1932 he caught a gravid female (weight 386 g) with 7 embryos. A male (weight 306 g) with very large testes was killed near the female on the 369 same tree. Nearby he found two young squirrels, one of which was a male (weight 121 g). The female was still feeding the young of the first litter, as her teats still contained milk. The embryos were 3×2 cm long, and were apparently in the second half of their development. This female had certainly copulated while still suckling the first litter, probably 20 days after birth. The period between the two litters was shortened by 15-20 days in this female.

Some authors state that squirrels may have a third and even a fourth estrus. M.P. Raspopov and Yu.A. Isakov (1935) record that they observed periods of rut in the Moscow Zoological Garden: the first in the middle of January, the second in the middle and end of March, the third in early June and the fourth in early August. The fourth estrus was observed in a female Teleut squirrel the third rut of which had taken place in early June. As the observations were carried out in a zoological garden, they cannot be applied to wild animals. First of all, the squirrels obtained a varied and plentiful food supply. This is important, as a good physical condition certainly furthers reproduction. Secondly, different geographical forms were observed in the zoological garden, central Russian Teleut squirrels and Manchurian squirrels. The heterogeneity of the material reduces the value of the results.

Estrus in autumn is rarely observed in squirrels of the same year which become gravid for the first time. G.K. Gol'tsmaier (1935) reports that on 16 November 1931 he obtained a 5-7-month-old female Teleut squirrel of which the teats had been sucked and the mammary glands functioned. If we assume that this female gave birth on 15 November, it must have had estrus on 10 October. Most females apparently reach sexual maturity only in spring of the next year, i.e., at an age of 8-12 months. The estrus of these young females lasts the whole spring. Yearling females usually do not have a second estrus. In Gol'tsmaier's opinion this explains the presence of many sterile females in the second half of summer. In the spring of the next year, estrus usually begins and ends earlier in 2-3-year old females than in one-year old ones. These females also have a second, summer estrus in June-July. Gol'tsmaier gives a table summarizing these phenomena (see below).

The table shows that the sexual cycle of the squirrel lasts about 8 months. During this time one may find females in rut and suckling their young.

Many authors observed that winter nests are often occupied by couples.
370 N.P. Naumov found a couple in a winter nest in the Turukhansk Territory. Similar observations were made by A.N. Formozov in oak forests in the vicinity of Gorki. He found that without exception all squirrels formed couples already in autumn. He also states that the Mari in the central Trans-Volga region make a peculiar squirrel hunt in autumn, beating the air with a switch or making noises with a ramrod in the barrel of a gun, to lure the animal. These noises resemble the sounds of the squirrels during the breeding period. This method resembles the autumn hunt of the hazel hen with a whistle. This system uses the fact that the hazel hens form couples already in autumn and each is attracted by the voice of the other sex (the voices of the male and female hazel-hens differ slightly).

Periodicity of estrus of the Teleut squirrel (Gol'tsmaier)

Months / Age	January	February	March	April	May	June	July	August	September	October	November	December
Subadultus (4.5-12 months old)								Estrus rarely				
Adultus (1-2 years old)			Estrus				Estrus possible exceptionally					
Adultus (2-3 years old)		Estrus				Estrus						

Another interesting feature of the sexual cycle of the squirrel is the ability of gravid females to hide in the forest. S. V. Lobachev (1932) described the second estrus and beginning of gravidity as follows: "It seemed as if there were no females at all in the forest. This was clear proof of the ability of the gravid females to hide in high and dense spruce trees, only rarely descending to the ground."

The number of young in each litter varies greatly, five to ten in adult females and three to six in young ones. N. P. Naumov ("Material on the Reproduction Rate of Squirrels" (Materialy k poznaniyu urozhaya belki), Trudy po lesnomu opytnomu delu, Issue VII, 1930, p. 107) did not find more than ten young in one nest. According to Gol'tsmaier the number of young in each litter is four to six (five on the average), but these data are based on little material. The number of young per litter is affected by the age of 371 the female and by its nutrition. N. P. Naumov's observations (1934) in the Surgut Territory show the connection between the rate of reproduction, i.e., the number of embryos, and the nutrition of the female. In this district the squirrels suffered severe famine during the winter of 1931-1932 because of a very poor pine-nut crop in 1931. Local hunters found squirrels which had starved to death in spring. It was found that the stomachs of the dead animals were either completely empty or full of conifer buds, Polyporus betulinus (a fungus on birch) and lichens (Usnea). The animals were emaciated. This poor physical condition delayed the estrus. Resorption of embryos also took place. The uterus of a female caught on 24 July 1932 contained eight embryos. Five of them were of normal size, but the others were less than half as large. The resorbed embryos were not in one group at the tip of the uterus, but alternated with normal ones. Thus, starvation caused a reduction of progeny by 37.5%, by resorption of embryos. According to N. P. Naumov, the reduced reproduction of squirrels in summer 1932 seemed due to E-avitaminosis*. E. M. Vermel' made histological studies of organs of squirrels obtained in the Surgut expedition. He found pathological degeneration in the liver and adrenals. The changes consisted in an increased absolute and relative number of binucleate cells, and in the appearance of cells with four and eight nuclei in the liver. This indicates a deterioration of the physiological condition of the animal. He also found that the adrenal medulla disappeared.

These histological changes were found only in adult squirrels which had suffered from the winter famine. Young squirrels were not affected.

The development of the young was recently described by V. G. Stakhrovskii (1932), M. P. Raspopov and Yu. A. Isakov (1935) and G. K. Gol'tsmaier (1935). According to M. P. Raspopov and Yu. A. Isakov, the newborn are completely naked, their skin is pink and their eyes show in a lilac color through the eyelids. The groups of vibrissae are already visible. When the young are taken out they roll into a ball, curl their tail between the legs and cuddle up against each other.

Measurements and weight of the newborn common Moscow squirrel:

Sex	Weight in grams	Body length in cm	Tail length in cm
Male	8	5.6	2.6
"	7.5	5.6	2.1
"	8.5	5.3	2.3
"	8	5.6	2.4
"	7	5.1	2.2

372 The toes of the newborn are connected. The toes of the forelegs separate first, the lateral toes before the inner toes; the inner toe separates first. The toes of the hind legs separate in the same order. According to M. P. Raspopov and Yu. A. Isakov, the toes of the forelegs separate on the 9th day, and those of the hind legs on the 12th day.

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* Vitamin E is an antisterility vitamin which stimulates reproduction. It is present in the germs of wheat and other seeds, and in vegetable fats.

The claws of the newborn are white. On the 2nd day pigment spots appear on the claws, under the skin and at the base of the claws. Translucent blood vessels appear at the tip of the claws. The pigment spot at the base of the claws later enlarges towards the tip. The claws attain their definite pigmentation towards the 30th day.

The ears of the newborn are covered with skin and pressed to the head. The skin is gradually drawn in, and on the 4th day the ears begin to project and the cartilages develop. On the 9th day the invagination of the skin continues, and the posterior cartilage projects. On the 18th day the anterior cartilage is differentiated, and its margins diverge. On the 20th day the ventral cartilage takes shape and the skin becomes so deeply invaginated that the auditory meatus is clearly visible on the 21st-22nd day.

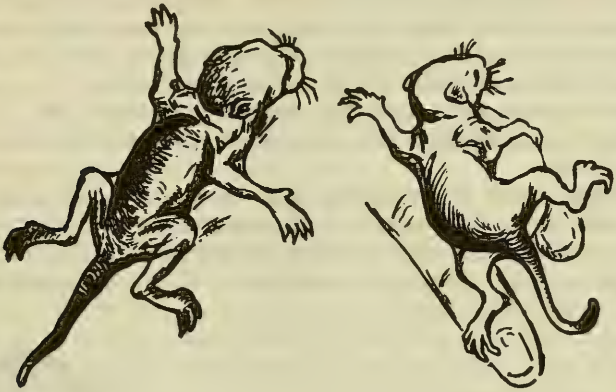

FIGURE 180. Eighteen-day-old squirrels
Drawing by V. A. Vatagin

Eyelids, eye-slits and eyelashes are well formed on the 27th day. The eyes open on the 29-30th day.* When the eyes open the animals are able to climb.

G.K. Gol'tsmaier (1935) observed that the legs grow irregularly in this early stage. They are very short in the newborn. When the animals begin to see the legs are very long. This is possibly an adaptation which enables them to fall from considerable heights without injury. Gol'tsmaier observed such a young animal falling from a height of 5 m onto sand, without any harm.

M.P. Raspopov and Yu.A. Isakov observed that the gums of the mandible became swollen on the 13th day. On the 20th day the gums had projecting tubercles with well marked blood vessels at the tip. On the 21st day the lower incisors broke through in three out of five young. They were 0.5 mm long. On the 22nd day the lower incisors broke through in the remaining two young.

373 In young Teleut squirrels in the Moscow Zoological Garden the incisors broke through on the 22-23rd day. Three days later they were twice as long (1 mm) but were still loose and movable.

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* According to V. G. Stakhrovskii (1932), the eyes of the Moscow squirrels open on the 36-37th day. According to Gol'tsmaier, the eyes of the Teleut squirrels open on the 33rd day.

The upper incisors of Teleut squirrels could be felt through the gums on the 30th day. They broke through, however, only on the 37-39th day. In the common Moscow squirrel this was delayed; the incisors broke through only on the 41st day. At this stage the lower incisors were already 6-7 mm long. The molars could be felt through the gums on the 45th day. The only hair on the body of the newborn was groups of vibrissae (see above). On the 3rd day a few hairs could be seen with a magnifying glass on the spine near the base of the tail. On the 4th day, a few pigmented short hairs could be seen all over the body with a magnifying glass. These hairs rapidly become dense on the occiput. White hairs appear on the belly of 6-day-old animals. From the 8th day the skin takes on a blue-lilac tone in some places. The first parts to darken are the tail and the hind soles. The pigment in the bulbs of the new hair then spreads to the spine and the whole back. At the same time both sides of the feet become dark. On about the 20th day the dorsal side of the animal is covered with dense reddish hair. On the 30-32nd day tufts 3 mm long begin to grow on the ears. At this stage the terminal hair of the tail is 20 mm long.

It is not known exactly when the animal is weaned. M.P. Raspopov and Yu.A. Isakov observed that the young still sucked on the 43rd and even the 52nd day of life.

V.G. Stakhrovskii (1932) thinks that the young begin to feed independently about the 40th day. This agrees with observations of other authors. The animals probably do not stop sucking altogether in the first period of independent feeding. This was reported by M.P. Raspopov and Yu.A. Isakov.

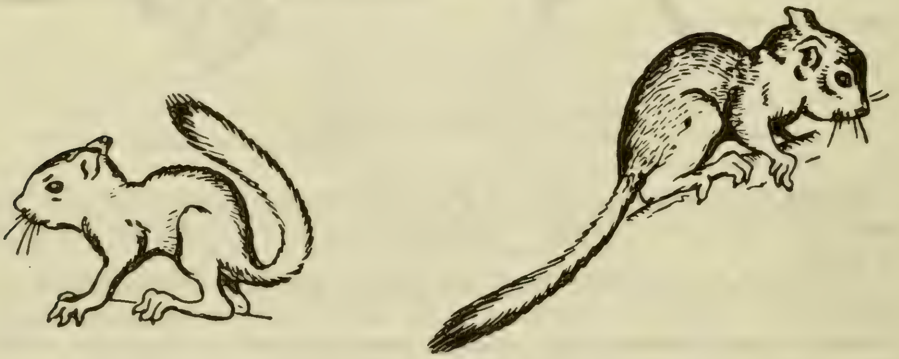

FIGURE 181. Forty-day-old squirrels

Drawing by V.A. Vatagin

374 G.K. Gol'tsmaier (1935) states that blind newborn tolerate fasting well. A one-day fast does not cause any harm, but perhaps retards growth.

The daily increase in weight of the newborn varies. It is about 1.5 g on the average. The curve of growth and increase in weight is irregular. According to M.P. Raspopov and Yu.A. Isakov, a 5 1/5-month-old Moscow squirrel has the weight and size of an adult. The weight of such a specimen was 250 g, and it was slightly heavier than its father.

G.K. Gol'tsmaier observed that young Teleut squirrels of the spring litter reach the size of the adults in 4-7 months.

M.P. Raspopov and Yu.A. Isakov (1935) observed that 47-day-old Moscow squirrels could already climb on trees. After descending to the base of a tree, they held on to the trunk with their hind feet and reached for food on the ground with their forefeet and teeth. They thus collected pine nuts in the open-air cage and bit off shoots of Chenopodium. On the 52nd day they fed on pine nuts, strawberries and bilberries.

Adult females take good care of their young. They sleep with them in the nest during the suckling period. In case of danger they transfer them to another nest. V.G. Sakhrovskii (1932) saw the following in the 47th section of the Pogonno-Losinyi forest. A female, with a litter of open-eyed young, clinging to her neck, climbed on a tree and jumped from one tree to another.

Gol'tsmaier states that the female transfers her young from one nest to another two or three times. He writes: "Transferring her young, the female held its flank between the teeth so that the head of the young was under her head and its tail above her neck. The body, head and feet of the young were rolled up under the head of the mother, not to hinder her running. The female runs on the ground for long distances, when carrying her young, climbing trees only in case of danger. The female moves in a short gallop. A female who is forced to climb a tree may drop the young. The young squirrel then climbs helplessly on the tree, and the female remains beneath it, probably to catch it when it falls."

Much has been published on the molt of squirrels. The most important is an article by Prof. B.A. Kuznetsov, "Fur Structure and Molt in the Squirrels" (Stroenie mekha i lin'ka belki.— Izvestiya Assotsiatsii nauchno-issledovatel'skikh institutov, I (1-2), Moscow 1928). This work was supplemented and corrected in parts in N.P. Naumov's article "Biology of the Reproduction of the Common Squirrel" (Biologiya razmnozheniya obyknovennoi belki, in the collection "Ekologiya belki" (The Ecology of 375 Squirrels), Moscow 1934), and also by G.K. Gol'tsmaier (loc. cit., 1935), M.P. Raspopov and Yu.A. Isakov (loc. cit., 1935).

The autumn molt of the squirrel has been studied in detail, but not the spring molt.

N.P. Naumov (1934) came to the following conclusions:

1. The spring molt starts on the head and proceeds towards the tail. The first part to molt is the "spectacles" around the eyes. At the same time the molt begins on the occiput along the line connecting the middle of the ears. Much earlier [sic], the hair of the tail begins to fall out. However, the skin does not yet show any signs of molt.* The molt of the head then spreads to the cheeks, forehead and ears. From the head the molt spreads to the shoulders and back, along the spine. At this stage, the lead-gray or bluish color of the skin of the back becomes rust colored due to the appearance of new hair. The molt then spreads to the flanks and legs. At this time the molt has not yet begun on the tip of the muzzle and the ears. The duration of the spring molt, like that of the estrus, depends on the physical condition of the animal. The spring molt follows immediately after the spring estrus. The males molt first and the molt lasts until the middle of the summer. Molt begins later in females, but is more rapid, and ends with the birth of the young.

2. The tail molts once a year. The other fur molts twice a year. The molt of the tail is very prolonged. In the first molt period** (at the end of

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* This is generally true of all molting parts of the body, in which the appearance of dark spots and patterns on the skin is preceded by loss of hair.

** Before the beginning of the spring estrus.

winter) part of the ordinary and guard hairs and nearly the whole underfur fall out. The fur of the tail becomes stiff. The molt of the tail begins after an interruption (resting stage) in the second half of June. It begins in the middle of the tail and continues towards the tip and the base.

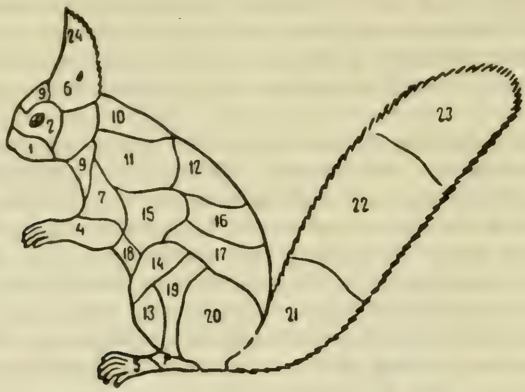

FIGURE 182. Diagram of sequence of spring molt of the squirrel

After M. P. Raspopov and Yu. A. Isakov

3. The autumn molt begins at the root of the tail. The first stage is the appearance of small, isolated groups of hair forming patches or stripes on
376 the buttocks near the tail. The molt intensifies and the area at the base of the tail becomes larger, cordiform and of a uniform bluish black color. This area is surrounded by a zone of lighter color which gradually becomes pale towards the periphery. The spot then widens towards the head in two stripes (B. A. Kuznetsov). The area between these two stripes does not molt for some time. At the same time the hind legs begin to molt. The autumn molt ends on the nose, occiput and forelegs. It is not the same in the two sexes. The males molt first, immediately after the heat. Females begin molting at the end of the breeding period. They molt, therefore, much later than the males. Adults molt in two stages. Females in their second pregnancy begin to molt about one month later than those which do not reproduce a second time. These differences make it possible to determine the number of sterile females which do not become gravid a second time. In autumn sterile females molt soon after the males.

Molt in young squirrels of the same year. After leaving the nest the fur of the young is delicate, short and sparse, but it grows gradually and becomes denser. The thin and easily torn skin becomes tougher and thicker. In summer the color of the skin becomes blue because of the appearance of new hair and the growth of the present hair, but there is no molt. The fur on the lower part of the back and the tail reaches its full length first. This continues towards the head, and ends on the occiput and the forehead. While the fur of the body reaches its full length the fur of the tail molts. Before molt the fur of the tail is short, luxuriant and soft. After molt it becomes dense, long, with well developed guard hairs which give thickness and the typical bilateral "combing" of the hair. In the second half of August the fur of the young of the first litter reaches its full length, and the molt of the tail ends in early September. The molt of the young

377 begins in September and follows the same sequence as the autumn molt in adults. It seems impossible to determine a difference in the molt periods of young males and females. The molt of the young squirrels to some extent lags behind that of adult males and considerably precedes that of adult females.

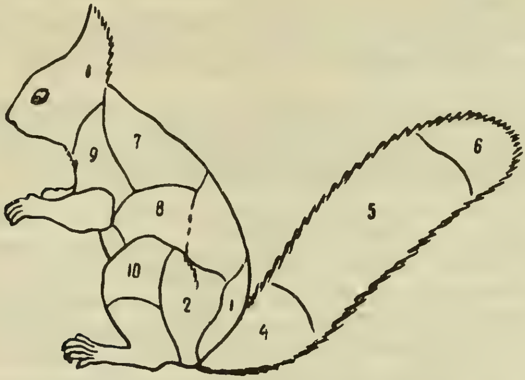

FIGURE 183. Diagram of the sequence of autumn molt in the squirrel

After M. P. Raspopov and Yu. A. Isakov

G. K. Gol'tsmaier records that on 16 November he found a young female of the first litter with complete summer fur and clear skin. Her mammary glands secreted milk, as she was gravid in her first autumn. Pregnancy apparently retarded the molt in this female.

Molt in young Teleut squirrels

Stage of molt	Age in months	Date of capture	Sex
Beginning	4	19 Sept.	female
	5	24 Sept.	male
	2.5-3	9 Sept.	female
	3	13-15 Sept.	female
Middle	4.5	9 Oct.	male
	3.5	19 Oct.	male
End	5.5	31 Oct.	male
	4.5	1-4 Nov.	female
	3	18 Nov.	male

N. P. Naumov (1934) studied molt periods and molt in young squirrels of the second litter. He found that they molt rapidly, as they have little time until the beginning of frosts. Unlike the first litter, they do not pass through a long period in which they attain full size and grow new hair. Squirrels of the second litter thus begin the autumn molt immediately. N. P. Naumov observed that body and tail molted at the same time in some cases. This never happens in adults or in young of the first litter.

As stated above, duration of molt depends on the physical condition of the animal and on its sex. Males begin to molt earlier. The skin of the scrotal region becomes blue even during estrus. However, molt is more prolonged in males than in females. In males it often lasts until the second estrus, sometimes even including estrus. The females begin molting later, but the molt is more rapid and ends with the birth of the young.

M. P. Raspopov and Yu. A. Isakov observed molt in squirrels of the Moscow Zoological Garden.* They found that the spring molt lasts 2 1/2-3 months, and the autumn molt 1-3 months.

378 G. K. Gol'tsmaier (1935) gave a table (p. 327) which shows that the older the animal the sooner molt begins and ends, and the younger the animal the later it molts.

G. K. Gol'tsmaier found that at all ages autumn molt begins in August and ends in December. In the following table he arranges the molting period in age groups, without distinguishing between sexes:

Molt in Teleut squirrels

Age	Months				
	August	September	October	November	December
Juvenis	—	Molt begins in the second half of the month	Molt	End of molt	End of molt in late litters
Subadultus	—	Molt begins in the first half of the month	Molt	Molt ends in the second half of the month	Molt of females born in autumn
Adultus	Molt begins in the last days of the month	Molt	Molt	Molt ends at about the 20th of the month	Presumably, end of molt in females born in autumn

Squirrels migrate in various seasons. The most intensive migrations take place in late summer and in autumn. These migrations were recently described by N. P. Naumov (1930, 1934), S. V. Lobachev (1932), and especially by A. N. Formozov (1934, 1936).

Fluctuations in numbers of squirrels have been known for a long time by hunters and have been described in the zoological literature. The tables in N. P. Naumov's work "Periodicity of Fluctuations in Numbers of the Common Squirrel" (Periodichnost' v kolebaniyakh chislennosti obyknovennoi belki, in: "The Ecology of the Squirrel" (Ekologiya belki), Moscow 1935, pp. 27-31) show clearly that these fluctuations may cover large areas. On the other hand, migrations consist only in a regrouping of populations on relatively small areas of their range, not more than some hundreds of kilometers. A. N. Formozov (1935) writes: "Fluctuations in numbers and migrations are related, but the latter are of a subordinate character. Mass migrations are a result of mass reproduction. An increase of the squirrel population may result from immigration of animals from other areas, and a decrease of the population may be caused by emigration of animals. Reduced numbers of squirrels are a result of
379 epizootics and a low reproduction rate. These two are the result of famine after crop failure. Reduced reproduction is thus the reaction of the population to unfavorable conditions. The migrations, which are fatal for

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* Without distinguishing between the sexes.

most migrating animals, are a similar reaction. They are a rapid and immediate response to adverse conditions... Epizootics are a delayed response. After crop failure, sick squirrels are usually found in late autumn. The greatest numbers of dead, frozen and weak animals are found in the middle and the end of the winter. Squirrels are completely absent or occur in very small numbers a year after a crop failure, i.e., in the next hunting season, which may be a season with plenty of food."

Fluctuations in numbers and migrations of squirrels depend largely on the food supply. It was found that years with plenty or with very few coniferous seeds occur with a certain periodicity. Years of plenty are followed by a rest period of the conifers, which may consist of several years with poor crops. The squirrel populations show the same periodicity. It should be stressed that multiplication of squirrels is preceded by rich crops of coniferous seeds. Data on the periodicity of crops of coniferous seeds have been published. In the Moscow Region spruce crops recur at an interval of 3 years, in the Leningrad District every 4 years (A.N. Formozov, "Fluctuations in Numbers of Commercial Animals" (Kolebaniya v chislennosti promyslovykh zhivotnykh), Moscow 1935, pp. 39-40). The cedar crops have a different periodicity which varies with the locality. According to A.N. Formozov (1935), cedars yield crops every 3-4 years in the western part of their range and in the central part of the Siberian taiga. Rich crops are rare in the Narym Territory and in general in the northern taiga. They recur at an interval of 7-8 years, according to some authors every 10 years. In the European part of its range, the Siberian larch gives crops every 6-7 years, possibly every 7-10 years. Pines give crops frequently in the Moscow Region, almost every year. In the central part of the U.S.S.R. rich pine crops recur every 3-5 years, in Lapland every 10 years, at 68°30 N every 10-20 years, and in Prussia every 3 years.

The periodicity of coniferous crops is connected with climatic and soil conditions, insolation rate, density of forests, etc. Regions with a mild climate, good soil and adequate insolation, e.g., forest borders, have rich crops and smaller intervals between the years of plenty. Different regions with the same conifer species have a different crop periodicity. Some isolated areas in different parts of the range of a species of tree may have similar crops at similar time intervals. A.N. Formozov (1935) proposes to call such areas "regions of similar productivity".

If the crop periodicity of conifers in a district is known, years with many squirrels, famine years and migrations can be predicted accurately.

380 There are also accidental, secondary factors which may affect the squirrel population, e.g., climatic phenomena of some years such as late or early frosts, rainy spring, summer or autumn, sever winter frosts, summer droughts, etc.

Natural calamities like forest fires, mass infestation of seeds by insects, etc., have also to be mentioned. Such events may result in movements and migrations of squirrels.*

A.N. Formozov (1933) observed that low reproduction and local migrations of Siberian squirrels (caused by poor pine-nut crops) occur together with migrations of Nucifraga caryocatactes macrorhynchos to Europe. Migrations of Nucifraga c. macrorhynchos to Europe make it possible to predict exactly reduced squirrel populations in the northern Urals and Siberia. In years with poor pine-nut crops this bird appears in the southern Urals and in the central Volga Region in August. The Siberian squirrel population can thus be predicted 2-2 1/2 months before the squirrel hunt.

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* Summer migrations of squirrels are usually caused by drought or forest fires.

Loxia curvirostra, Loxia pytyopsittacus and Loxia leucoptera bifasciata also migrate after the failure of spruce and pine crops. Reduced squirrel populations and migrations in regions with poor crops can be predicted by the migrations of these birds.

Squirrels generally migrate in a "broad front". Such a front was 300 km long in 1928 in the lower reaches of the Amur, 100 km long in 1917 along the Northern Dvina and 300 km in 1930 in the Leningrad Region. Migrating squirrels never move in compact groups, like reindeer herds. They move singly, sometimes out of the sight of their fellows. The squirrels become more crowded when the animals cross obstacles, e.g., rivers. The size of the flock affects the migration rate. The greater the number of animals, the quicker the available food is consumed, and the shorter the stay in a locality. The rate of migration is 3-4 km/hour on the average. The time in which migrating squirrels pass a given point can be determined by observation points which are very few in the Soviet Union. In 1917 the squirrels migrated through the Northern Dvina region for more than 45 days (A.N. Formozov). In 1932 they migrated across the Ob (the Surgut Territory) for more than 2 months (N.P. Naumov and I.D. Kiris).

Migrating squirrels often surmount considerable obstacles. They then become less timid and more excited than usual. They swim across rivers
381 and lakes on their way. Squirrels have been observed to cross the Klyaz'ma, Selendzha, Msta, Volkhov, Vyatka, Kama, Northern Dvina, Sos'va, Yenisei, Amur rivers, etc. According to B. M. Zhitkov (1935), a mass migration to the northeast was observed in the Sos'va District (east of northern Urals) on 4 June 1935. The squirrels swam across 1 km of water. Many of them drowned. Squirrels are not stopped even by such wide water bodies as the Tatar Strait, Taz Bay, and Chivyrkui Inlet of Lake Baikal, which is about 12 km wide.

Migrating squirrels which swim across rivers may climb on rafts, boats, barges and steamers for rest. They may enter large towns like Kirensk, Tyumen', Petrozavodsk, Krasnoyarsk, Tomsk and even the outskirts of Moscow.

It is usually difficult to determine the distances covered by the migrating animals. Squirrels have been observed to migrate 250-300 km beyond their usual range. According to S.I Orlov (1930), squirrels never occurred in the Taz District (67°20' N and 49°50' E). However, large numbers of squirrels migrated along the Taz in autumn 1923. They reached the Taz Bay and attempted to swim across. This attempt proved fatal because the animals were exhausted from the long journey and starvation in the tundra (the dwarf larch trees of the tundra did not supply sufficient food). Orlov adds that in spring 1924 he found several squirrel nests in dwarf alder forests. However, the squirrels in them were frozen to death.

In 1932 squirrels appeared on the Kanin Peninsula, about one degree north of the forest limit.

The migrations of squirrels to Kamchatka are noteworthy from the point of view of zoogeography. It has been generally accepted that no squirrels live or ever lived in Kamchatka, as the way to it is barred by the tundra.

According to P.T. Novograblenov (1930), a report was received in Petropavlovsk in 1920 that squirrels had appeared in northern Kamchatka. No such reports were received before that date. The appearance of squirrels in Kamchatka was received with great surprise by the hunters, and the animal was regarded as a rarity. In winter 1923-1924 it was definitely established that squirrels had invaded Kamchatka. This migration was preceded by increased numbers of squirrels in northeastern Siberia, probably because of rich food crops. The squirrels apparently entered Kamchatka from Gizhiga and Penzhina*, through the valleys of the Talovka, Pustaya, Lesnaya, Palan and Tigil' rivers. During this migration, the squirrels crossed the so-called Parapol'skii Dale, a broad tundra area covered with mountain-pine thickets. From the valley of the Tigil' river they continued through the valley of the Anaun and Kozyrevka rivers, and finally reached the valley of the Kamchatka river. The animals moved up and down this valley until they reached the valley of the Avacha river. According to unpublished data by S.N. Barmantov (1932), squirrels were
382 found along the Dvugortochnaya and Kamchatka rivers after their occupation of the peninsula. Many specimens were found in the region of Mil'kovo-Nachiki. The squirrels then slowly began to appear in the Petropavlovsk District, e.g., in the villages Koryaki, Elizovo, Nalychevo, and Nikolaevka.

In the final stage of long migrations the squirrels lose their purpose. As remarked by A.N. Formozov, they move in a state of abnormal excitement and sometimes arrive at very barren places. Such migrations may end with the death of the whole population.

Squirrels do not hibernate and are active even during severe frosts (according to G.K. Gol'tsmaier's observations in West Siberia). In East Siberia, e.g., in the Turukhansk Territory, the squirrels keep to their nests and remain inactive during the second half of winter, when the severest frosts occur. The same is sometimes observed in the central and northern parts of European U.S.S.R.

P.A. Manteifel' (1927) states that squirrels are never seen outside their nests during severe frost; they stay in them in a semi-somnolent state.

The squirrel has many enemies. In eastern Europe it is persecuted by the pine marten, which attacks it at night in its nest. In Siberia the squirrel is hunted by the Siberian ferret. In northeastern Siberia squirrels are possibly suffocated in their nests by ermines (S.I. Ognev, 1926). According to V. Iokhel'son (1898), hunters in the Kolyma Territory state that squirrels are attacked by flying squirrels. Iokhel'son writes: "During the fight the flying squirrel spreads its parachuting membrane. The squirrel bites into this membrane and tears it, but the flying squirrel wins just like the ermine."

This doubtful observation was recently discussed by G.K. Gol'tsmaier (1935). He writes: "The hunters of the Srostinskii pine forest consider the flying squirrel an enemy of the Teleut squirrel and believe that it eats both adult and young squirrels, and then occupies their nest. Hunters of the Verkhneobskii pine forest state that the flying squirrel only occupies nests of squirrels, but does not cause them any harm. Our observations do not confirm that the flying squirrel attacks the squirrel, but the flying squirrel certainly occupies its nests. Almost all flying squirrels caught in the Srostinsk pine forest (in which they are numerous) were found in squirrels' nests. The question is whether the flying squirrel drives the squirrels out, or settles in abandoned or auxiliary nests. The fact that we found a flying squirrel in a freshly built squirrel nest (on 24 August) is in favor of the first alternative."

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* I.N. Malyshev (1936) thinks that the squirrels entered Kamchatka mainly through the valley of the Penzhina river.

These ecological aspects of the biology of squirrels and flying squirrels should be verified.

The most serious enemy of the squirrel is the goshawk. It is also hunted 383 by sparrow hawks, kites and various owls, e.g., tawny owl, Ural owl and eagle owl. Crows and magpies are dangerous to young squirrels which have left their nest but do not yet climb well.

The squirrel is of great commercial value. The yearly production of squirrel furs constitutes about 30% of the whole Russian production of furs (B.A. Kuznetsov, "Science of Staple Commodities" (Tovarovedenie), Moscow 1932, p. 335). According to A. Emel'yanov ("Pushnoe Delo", No. 1/2, 1927, p. 16), an average of 15 million squirrel pelts were processed yearly. In the late 1920's about 10 million pelts were exported.

The squirrel hunt is called in Russian "belkovan'e" or "belkov'e", and squirrel hunters are called "belkovshchik". Squirrels are usually hunted with dogs. Amateur hunters in the central part of European U.S.S.R. often hunt with mongrel dogs, claiming that they are better suited for hunting mammals and birds. The object of the dogs is to find the squirrels and bark when they climb the trees. When the squirrel hunters begin the hunt, they send the dogs to look for the animals. Sometimes the squirrel does not fear the barking and even looks at the dog with curiosity. However, it sometimes becomes frightened and passes to other trees as when the dog stands up and scratches the bark of the tree. Experienced dogs usually sit calmly some distance from the tree and try not to lose sight of the victim. The animal is sometimes so well hidden that it is not visible. The hunter then waits until the animal shows itself by a movement, or he beats the stem of the tree, forcing the squirrel to move. Huskies are especially suitable for this hunt. Squirrels are usually shot with shot guns or small-bore rifles.

Squirrels are rarely caught with traps. The only type of trap suitable for squirrels is the "plashka". It consists of 2 boards one above the other. These boards are fixed so that they form an acute angle. The lower board is fixed in notches between the trunks of two trees. The movable heavy upper board is raised and held by catches and a horizontal piece with a bait. The "plashka" is usually fixed 1-1.5 m above the ground. When the squirrel touches the bait the upper board drops and crushes it. Squirrels are also trapped by crossbars. Branches are split and the two halves are pulled apart and held by catches. When the animal touches the bait, it operates the catch and is caught by the closing halves of the branch.

Fleas (Ctenonotus octodecimdentatus) and ticks are 384 ectoparasites of the squirrel. Its intestinal parasites include tapeworms and the following nematodes: Syphadia obvelata, Viammia scrjabini, Strongyloides and some species of Heligmosominae (Family Trichostrongylidae), etc.

359. **Sciurus vulgaris ognevi Migulin (1928). Central Russian squirrel**

1895. Sciurus vulgaris Satunin K. A., Pozvonochnye Moskovskoi gubernii, Mlekopitayushchie (Vertebrates of the Moscow Province. Mammals), p. 10.

1913. Sciurus vulgaris subsp. Ognev S. I., Mlekopitayushchie Moskovskoi gubernii (Mammals of the Moscow Province), pp. 265-281.

1925. Sciurus vulgaris varius Turov S. S., Mlekopitayushchie Ryazanskoi gubernii (Mammals of the Ryazan Province), p. 59.

1927-1928. Sciurus vulgaris ognevi Migulin A. A., Obzor gryzunov Ukrainy (A Survey of Ukrainian Rodents), "Zakhyst roslyn", No. 3-4, pp. 12-13.

1929. Sciurus vulgaris Kuznetsov B. A., Zametki o faune mlekopitayushchikh Pogonno-Losinoostrovskogo lesnichestva (Notes on the Mammal Fauna of the Pogonno-Losinoostrovskii Forestry), Trudy po lesnomu opytnomu delu, Tsentral'naya lesnaya opytnaya stantsiya, Issue VI, p. 107.

TYPE LOCALITY AND DEPOSITION. Former Borovsk County of the Kaluga Province. Type in Kharkov Central Station for Plant Protection.

MATERIAL EXAMINED: 155 specimens.

DIAGNOSIS. Winter fur of two types: 1) spruce-inhabiting squirrels: gray with a buff tinge. Spine and lower part of back often with brownish rust tones ("bald-spine"). Tail of the brown or dark brown type (see above); 2) pine-inhabiting squirrels: back light ash-gray with a buff tinge. Bald-spine usually well marked, rust-red. Tail of the red type. Red-tailed squirrels constitute 25-30% of all squirrels.

The color of summer fur on the back varies from intense red-chestnut-brown (in dark brown-tailed specimens) to light ocher-reddish rust (in light red-tailed specimens).

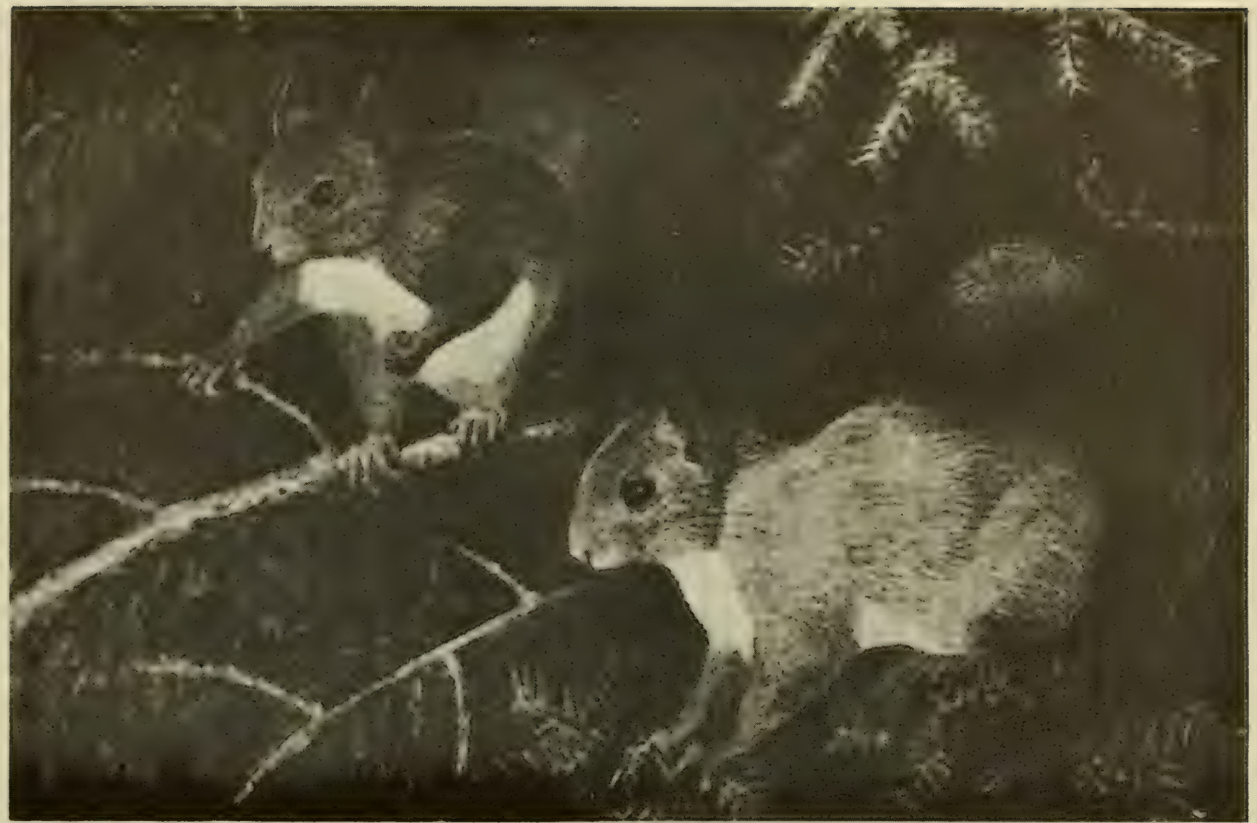
MEASUREMENTS small: length of skull (Figures 165, 168, 184) 47.2-53.2 mm (M. 51.2 mm), condylobasal length 42.8-48 mm (M. 46.4 mm); zygomatic width 29.8-33.4 mm (M. 31.5 mm); length of upper tooth row 8.3-9.9 mm (M. 9.2 mm); hind feet 54-61 mm (M. 57.8 mm); tail 160-190 mm (M. 173.1 mm).

DESCRIPTION. Color of winter fur of the two types as described. Many transitional colors occur.

1. Spruce-inhabiting squirrel, dark type (see Plate VI, lower figure). Back gray with a buffy tinge (mouse-gray). This tone sometimes approaches ash color. Dark gray mottling always well marked. Spine and lower part of back often with brown-rust-gray tones (bald-spine) on tips of underfur and broad subapical bands of guard hair.

Buff tones always well marked on head, nose and cheeks. Lower parts of cheeks and chin pale buff-gray color passing gradually into the white color of the throat. Base of ears usually brown-gray-buff. Two thirds of 385 the ears, including the tip are black-brown. Feet and part of antebrachium ocher-rust (between orange-cinnamon and sayal-brown). Belly and groin white. Squirrels of this type belong to the chestnut-tailed and dark-chestnut-tailed type. Dorsal side of tail black-gray with a slight rust tinge, which is well marked on the terminal hair. Hair roots dark ash-gray followed by buff-rust colored bands and black tips. Terminal hair of tail with buff-rust colored tips. Middle of ventral side of tail ash-gray, darkened by blackish hair tips. Sides of ventral side with buff-rust colored tones caused by the subapical bands.

PLATE VI



Central Russian squirrel (Sciurus vulgaris ognevi Migulin); upper figure, summer fur; lower figure, winter fur

Drawing by V. A. Vatagin

2. Pine-inhabiting squirrel, light type. Back light ash-gray with a **buff** tinge (light mouse-gray); spine and lower part of back with "bald spine" consisting of reddish rust tones. Back with dense mottling of a darker gray. Rust tones present on head, cheeks and forehead. Ears light ocher-red (between orange-cinnamon, mikado-brown and tawny). Feet and antebrachium of forelegs reddish rust colored. Tail of the red-tailed type. Dorsal side of tail reddish brown-ocher (between orange-cinnamon and tawny). Hair roots on dorsal side light ash-gray, with brownish ocher-red apex. Some hairs have a black apex. The middle of the ventral side of the tail has well-marked ash-gray tones. Sides of ventral area with a broad stripe caused by rust-red hair tips.

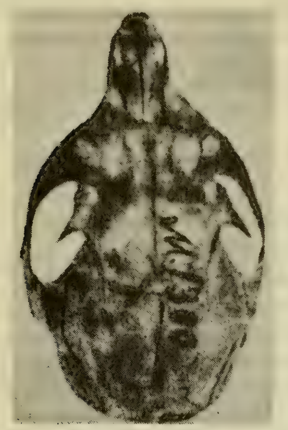


FIGURE 184. Skull of Sciurus vulgaris ognevi Migulin, No. M. 1300, Moscow Region (former Moscow Province)

The summer fur (Plate VI, upper figure) also shows two types connected by transitions.

In squirrels of the dark type, back red-brown-chestnut (between kaiser-brown and tawny). Nose and cheeks reddish rust-buff of varying intensity. Occiput with darker brownish tones like in the middle of the back. Flanks and legs more pure reddish rust (between ferruginous and tawny). Throat, chest, belly and groin white. Sides of throat pale buff-rust, little differing from white middle part of throat. The white throat area of the summer fur of most squirrels is wedge-shaped anteriorly. Tail of the dark chestnut type. Roots of hair on tail light, buff-gray, followed by narrow blackish or black-brown bands, broader rust-buff subapical bands and still broader black or black-chestnut 386 tips giving a black-chestnut tone to the dorsal side of the tail. Middle of ventral side of tail dirty rust-gray. Sides of ventral area with a fringe of reddish-rust and black-chestnut tones. Margins of tail with a black-chestnut tone.

In specimens of the light type, the whole back (from the occiput) lighter, ocher-red-rust (between orange-cinnamon and tawny). Forehead and cheeks with buff-yellow shades near ochraceous-tawny. Flanks rust-orange (near zinc-orange). Tail of red-tailed type. Dorsal side generally red-ocher-rust (between orange-cinnamon and tawny). Hair roots light gray-buff, followed by narrow black-gray bands, and rust-red tips which are yellower proximally and redder and more rust colored distally. Middle of ventral side of tail light ash-gray, flanked by ocher-yellow tones. Sides of ventral area with a broad ocher-red-rust fringe.

GEOGRAPHICAL DISTRIBUTION. Throughout the central part of European U.S.S.R. The northern boundary apparently follows the line Luga - Novgorod - Kostroma - Perm. The western boundary follows the line Pskov - Velikie Luki - Torzhok - Vyaz'ma - Kaluga. The southern boundary begins in the southern part of the former Kaluga Province, continuing to Tula - Ryazhsk - Penza - Syzran', and turns north along the right bank of the Volga Belebei - Yelabuga. Near Birsk (on the Belaya river) the boundary meets that of S. v. bashkiricus. The eastern boundary turns north along the Kama to Perm.

360. **Sciurus vulgaris fedjushini Ogn. (1935). Belorussian squirrel**

1929. Sciurus vulgaris Fedyushin, A.V., Dinamika i geograficheskoe rasprostranenie okhotnich'ei fauny BSSR (Population Dynamics and Geographical Distribution of Game Animals in the Belorussian S.S.R.), Minsk, pp. 55-58 (partim!).

1935. Sciurus vulgaris fedjushini Ognev S.I. Sistematicheskii obszor belok, vodyashchikhsya v SSSR (A Systematic Survey of the Squirrels of the USSR), Byulleten' nauchno issledovatel'skogo instituta zoologii Moskovskogo universiteta, No. 2 p. 43.

TYPE LOCALITY AND DEPOSITION. No. M.3657, 22 October 1929. Pleshchenitsy Forestry of the Minsk District, A.V. Fedyushin. S.I. Ognev's collection.

MATERIAL EXAMINED: holotype and 68 paratypes.

DIAGNOSIS. Winter fur of two types. Squirrels with dark fur predominate. Back gray with chestnut and buff shades which are darker than in dark Moscow winter specimens. Grayish brown bald-spine usually well developed. Tail of the chestnut or dark-chestnut type. Winter fur of the light type usually darker than the light type of the Moscow squirrel. Gray tone with a dirty-buff tinge. Tail of the light chestnut or red-tailed type.

Summer fur of a saturated reddish brown, much darker than in S.v.ognevi.

387 MEASUREMENTS: Length of skull 51.6-53 mm; condylobasal length 48-49 mm; zygomatic width 31.7-32.5 mm; length of upper tooth row 9.6-10.5 mm; length of hind foot 57 mm.

DESCRIPTION. Squirrels of the dark type predominate. Back dirty-gray (between mouse-gray and deep mouse-gray, occasionally with a neutral gray shade), darker than in dark S.v.ognevi. Well marked gray-brown mottling on back. Many specimens show bald spine, i.e., well marked grayish brown tones on spine and lower part of back (between olive-brown and natal-brown). Flanks frequently with a buff tinge (buff-brown) which is also well marked on nose and cheeks, mixed with wood-brown and buff-brown tones. Base of ears brown, and the other parts chestnut-black. Soles chestnut-gray (between hair-brown and benzo-brown) with a rust tinge. This color is also marked on antebrachia and shoulders. Tail of the dark-chestnut or dark type. In tails of the dark type, the brown bands of the hair are almost absent and the tail is generally grayish black, with broad gray roots of the long guard hairs. Fur coarser and less silky than that of S.v.ognevi.

Squirrels of the light type are red tailed or light-chestnut tailed, differing from the Moscow pine-inhabiting squirrels in the darker gray color of the fur. Bald spine well marked.

Color of summer fur usually more intense than in most specimens of S.v.ognevi. Back saturated reddish chestnut (dark kaiser-brown). Nose, forehead and cheeks buff-gray (hair-brown) with a rust tinge and dark gray mottling. Flanks and legs richer red-rust colored. Chin and lower part of cheeks gray-buff (light drab) gradually passing into white in middle of throat. In red-tailed specimens dorsal part of tail of one color. In chestnut-tailed specimens tail with a marked black tinge, making the tail appear nearly black.

SYSTEMATIC NOTES. Although there are no skull measurements, this subspecies seems well characterized. Series differ from S.v.ognevi as follows: 1) darker tone of winter fur; 2) color of summer fur more intense; 3) lower percentage of red-tailed specimens; 4) fur coarser and less silky. Measurements larger than those of S. v. ognevi. This, however, should be confirmed.

GEOGRAPHICAL DISTRIBUTION. Not well known. The subspecies
388 apparently occurs in the forests of Minsk, Polotsk and Mogilev. In the north it occurs to about the Velikie Luki, in the east to the line Smolensk - Vyaz'ma - Roslavl'. These boundaries are not certain and should be verified.

361. Sciurus vulgaris formosovi Ogn. (1935). Northern squirrel, or Formozov's squirrel

1925. Sciurus vulgaris Shchegolev V. N., Fauna, biologiya i ekonomicheskoe znachenie mlekopitayushchikh Cherepovetskoi gubernii (The Fauna, Biology and Economic Value of Mammals in the Cherepovets Province), p. 18.

1925. "Belka" ("Squirrel"). Milovanovich D., Okhotnichii promysel v Perchorskom krae (Commercial Hunting in the Pechora Territory), "Okhota i okhotnik", p. 43.

1930. Sciurus vulgaris Lobachev S. V., Obzor okhotnich'ikh promystov Vyatskogo kraya (A Survey of Commercial Hunting in the Vyatka Territory), Trudy po lesnomy opytnomu delu, Tsentral'naya lesnaya opytnaya stantsiya, Issue VII, p. 72.

1932. Sciurus vulgaris Lobachev S. V., Verkhnevychegodskaya ekspeditsiya (The Upper Vychegda Expedition), pp. 97-147.

1935. Sciurus vulgaris formosovi Ognev S. I., Sistematicheskii obzor belok, vodyashchikhsya v SSSR (A Systematic Survey of the Squirrels of the U. S. S. R.), Byulleten' nauchno-issledovatel'skogo instituta zoologii Moskovskogo universiteta, No. 2, p. 44.

TYPE LOCALITY AND DEPOSITION. No. 7, female, 11 November 1930, Yakovlevo Village of the Sharya District of the Gorki Region (former Nizhnii Novgorod Region), A. N. Formozov. Type in S. I. Ognev's collection.

MATERIAL EXAMINED: holotype and 109 paratypes from adjacent districts.

DIAGNOSIS. Winter fur of one type. Back pure gray with well marked dark gray, dense mottling. Bald-spine rare. Tail of the chestnut tailed or dark chestnut-tailed type. Transitional specimens between chestnut-tailed and dark-tailed type occur rarely. Red-tailed specimens very rare, only 2-3% of the population. Summer fur of fully grown specimens dark, intense chestnut-reddish, darker than that of S. v. ognevi.

MEASUREMENTS. Length of skull 49-52.3 mm (M. 51.2 mm); condylobasal length 43-48.7 mm (M. 46.3 mm); zygomatic width 28.3-32.2 mm (M. 31.2 mm); length of upper tooth row 9-10 mm (M. 9.2 mm); hind feet 54-61 mm (M. 57.6 mm); tail 140-185 mm (M. 167.3 mm).

DESCRIPTION. Back pure gray (neutral-gray) with a light buff tinge (mouse-gray) and dense dark gray mottling. Series of this subspecies differ sharply from series of Moscow squirrels in their purer gray color. Bald-spine specimens are rarer than among S. v. ognevi. Forehead sometimes with a buff-gray tinge (drab). Specimens without buff tones on the head are common, their color is gray with darker mottling. Lower parts of cheeks and chin light gray or buff-gray, gradually passing into white in the middle of the throat. Color of flanks like that of back. Ears black, sometimes with a chestnut tinge at the base. Tail of the chestnut-tailed type. Dark-tailed specimens also occur. Gray roots of hair on tail well developed in some dark-tailed specimens from Arkhangelsk. Rust-brown hair on soles of winter fur sometimes retained.

There are rarely specimens with a color resembling that of the central
389 Siberian squirrel, i.e., with a reduced white area on the belly. To this type belongs specimen No. M.4242, male, of my collection (caught by

V. Parovshchikov on 29 September 1934 in the vicinity of village Tundra in the Kholmogory District, former Arkhangelsk Province). The back of this specimen is gray with dark mottling and a well marked bald-spine. Flanks of a purer gray slightly different from that of back. White area of belly reduced. Throat with a white wedge, which is surrounded by a dark gray fringe. Ears black. Tail of the chestnut-tailed type, with well developed black hair tips. V. Parovshchikov informed me that he found a specimen of similar color among many hundreds of squirrels from Arkhangelsk.

Summer fur of old specimens darker than that of old Moscow S. v. ognevi. Back between chestnut-brown and kaiser-brown, i.e., intense chestnut-red. Nose and cheeks with buff-gray-rust tones. Flanks in many specimens saturated red-ocher-chestnut (between orange-rufous and tawny). Feet of same color as flanks. A reddish orange tone in lower part of neck and on chin, surrounding a white wedge in the middle of the throat. Tail of the chestnut or dark chestnut type. Young much lighter and yellower.

SYSTEMATIC NOTES. Differs from S. v. ognevi as follows: 1) purer gray color of winter fur; 2) fur denser and more luxuriant; 3) lower percentage of bald-spine specimens*; 4) much lower percentage of red-tailed specimens (2-3% as against 25-30% in S. v. ognevi).

GEOGRAPHICAL DISTRIBUTION. S. v. formosovi occurs in northeastern Europe. The southern boundary of the range apparently follows the line Perm - Kostroma - Novgorod. It is also distributed in the basins of the Pechora and Northern Dvina. Squirrels of the Kholmogory District belong to this form, and not to the closely related form S. v. varius, but they are perhaps transitional to this. In Finland and the Kola Peninsula S. v. varius is replaced by S. v. formosovi. The squirrels at the coast of the Gulf of Finland are of an intermediate type, more closely related to varius than to ognevi. Along its southern boundary the range of S. v. formosovi passes gradually into that of S. v. ognevi.

362. Sciurus vulgaris varius Barrett-Hamilton (1899). ex Kerr (1792). Kola squirrel

1762. Sciurus varius Brisson A. D., Regnum Animale in classes IX, Lugduni Batavorum, p. 106.

1789. Sciurus vulgaris varius Gmelin in Systema Naturae Linnaei I, ed. XIII, p. 146.

1792. Sciurus vulgaris varius Kerr K., Animal Kingdom, p. 255.

1868. Sciurus vulgaris Kessler K., Materialy dlya poznaniya Onezhskogo ozera i Obonezhskogo kraya (Materials on the Onega Lake and the Onega Territory), Sankt Petersburg, pp. 21-22.

1884. Sciurus vulgaris Pleske Th., Uebersicht der Säugethiere und Vögel der Kola-Halbinsel, S. 105-108.

390 1899. Sciurus vulgaris varius Barrett-Hamilton G., On European Squirrels, Proceedings of the Zoological Society of London, p. 6.

1910. Sciurus vulgaris varius Trouessart E. I., Faune des Mammifères d'Europe, pp. 117-118; Miller G. S. Catalogue of the Mammals of Western Europe. London, 1912, pp. 906-907.

1928. Sciurus vulgaris varius Serebrennikov M., Synopsis of Russian Squirrels, Doklady Akaemii Nauk SSSR, p. 421.

TYPE LOCALITY AND DEPOSITION. Brisson, who described Sciurus varius records its distribution as follows "Habitat Europa". According to Gmelin and Kerr, its range is northern Europe. The first exact indication of the type locality was given by Barrett-Hamilton, i. e., northern Scandinavia and Lapland. Holotype unknown.

MATERIAL EXAMINED: 20 specimens.

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* The rust tone of bald-spine S. v. formosovi (on spine and lower part of back) is superficial, not deeply colored hair.

DIAGNOSIS. Winter specimens are mostly light colored and bald-spine. Specimens of a more intense gray color are rare. Bald-spine squirrels occur frequently. Tail usually of the chestnut-tailed type. Red-tailed specimens constitute 30% of the population. Dark-tailed specimens are rare. Winter fur more luxuriant and silky than in Moscow squirrels. Summer fur of adult specimens saturated, red-chestnut-rust colored.

Length of skull 49-53.6 mm; condylobasal length 44-48.6 mm; zygomatic width 30.2-31.6 mm; length of upper tooth row 9-9.8 mm.

DESCRIPTION. Winter fur. Back very light bluish gray in most Kola squirrels (between gull-gray and pale neutral-gray, Ridgway, 1912), with fine mottling. Nose and cheeks with a light gray-buff-rust tinge. Flanks lighter than back, of a pure gray-blue (gull-gray), sharply contrasting with the white belly. The color of the ears in such specimens varies between rust-red (tawny, mikado-brown) and black-chestnut or even black. Feet more or less rust colored. Tail rust colored as in chestnut-tailed specimens. Red-tailed specimens occur frequently, constituting 30% of the squirrel population of the Kola Peninsula. There are also many transitions between chestnut-tailed and red-tailed squirrels. The basal third of the tail in such specimens is of a rich reddish rust color (orange-cinnamon). Roots of hairs in this area bluish gray, followed by narrow blackish bands and broad reddish rust bands. Some hairs with small black tips. In the middle of the tail, particularly near the tip, the black hair tips become wider, so that the tail appears blackish. Tips of terminal hairs rust colored. Medium line of ventral side and base pale bluish gray. Sides of ventral area rust-red followed by a broad black-chestnut fringe. Fur luxuriant, soft and silky, similar to that of S. v. formosovi in full pelage.

Dark gray, dark-tailed squirrels are rarer on the Kola Peninsula. Back ash-gray (between light neutral-gray and neutral-gray) in such specimens, 91 with well marked dark gray mottling. Head dark ash-gray with fine dark mottling, and rust-buff tones on tip of nose and lips. Gray color lighter on flanks, giving a bluish shade. Feet, especially soles, with gray hair. Tail gray-black, without any rust shades. Hair roots of tail dark ash-gray; tips of hair of tail black.

Summer fur red-chestnut-rust colored (between kaiser-brown, Hay's russet with chestnut-brown shades). General color very similar to that of summer fur of S. v. formosovi. Forehead and cheeks with buff-rust shades. Rust-red tones on lower parts of cheeks and chin sharply set off by white wedge in middle of throat.

Flanks and feet rich rust-red color. Tail of the chestnut and dark-chestnut type. Red-tailed specimens are common (see above).

SYSTEMATIC NOTES. Differs from S. v. ognevi as follows: 1) usually purer light bluish gray winter fur; 2) denser, more silky and luxuriant fur; 3) bald-spine specimens rare as compared with the Moscow squirrel; 4) darker color of summer fur.

Differs from S. v. formosovi as follows: 1) lighter bluish gray color of winter fur; 2) large percentage of red-tailed specimens (30% as against 2-3% in S. v. formosovi); 3) large number of red-eared specimens which are very rare in winter specimens of S. v. formosovi.

I compared Swedish specimens of S. v. varius (from near Upsala) in the ZMAN collection with S. v. vulgaris and found that its summer fur is very dark, the tail chestnut colored. The back of Swedish specimens is dark chestnut, warm-sepia (pl. XXIX, Ridgway, 1912). The tail is still darker and the flanks more rust colored (with mikado-brown tinge, pl. XXIX).

The chestnut color is retained to a large degree in winter fur. A light silver-gray tinge at the hair tips. Skull small, length about 52 mm (cf. G. S. Miller's description in: Catalogue of the Mammals of Western Europe, 1912, p. 905).

GEOGRAPHICAL DISTRIBUTION. Kola Peninsula (Lapland and Finland). Squirrels from the Onega Territory apparently belong to this subspecies.

363. Sciurus vulgaris ukrainicus Migulin. Ukrainian rust-colored squirrel

1855. Sciurus vulgaris Severtsov N. A., Periodicheskie yavleniya v zhizni zverei, ptits i gad Voronezhskoi gubernii (Periodic Phenomena in the Life of Mammals, Birds and Reptiles of the Voronezh Province), p. 379.

1894. Sciurus vulgaris Silant'ev A. A., Fauna gadov (The Reptilian Fauna), Sankt Petersburg, p. 35; by the same author: Zoologicheskie issledovaniya (Zoological Investigations), Trudy ekspeditsii Lesnogo departamenta, IV (2): 11-12. 1898.

1915. Sciurus vulgaris Gorbachev S. N., Mlekopitayushchie Orlovskoi gubernii (Mammals of the Orel Province) [according to recent data], p. 6.

1923. Sciurus vulgaris fuscoater Ognev S. I., Fauna nazemnykh pozvonochnykh Voronezhskoi gubernii (The Fauna of Land Vertebrates of the Voronezh Province), pp. 153-154.

1924. Sciurus vulgaris fuscoater Migulin A. A., Mlekopitayushchie Khar'kovskoi gubernii (Mammals of the Kharkov Province), "Priroda i okhota na Ukraine", No. 1-2, pp. 119-128.

392 1927-1928. Sciurus vulgaris ukrainicus Migulin A. A., Obzor gryzunov Ukrainy (A Survey of the Ukrainian Rodents), "Zakhist roslyn", No. 3-4, 1927-1928, pp. 11-12.

1928. Sciurus vulgaris fuscoater Gavrilenko N., Opyt sistematicheskogo kataloga zverei Poltavshchiny (A Systematic Catalogue of the Mammals of the Poltava District), p. 10.

1928. Sciurus vulgaris fuscoater Serebrennikov M., Synopsis of Russian Squirrels, Doklady Akademii Nauk, p. 425.

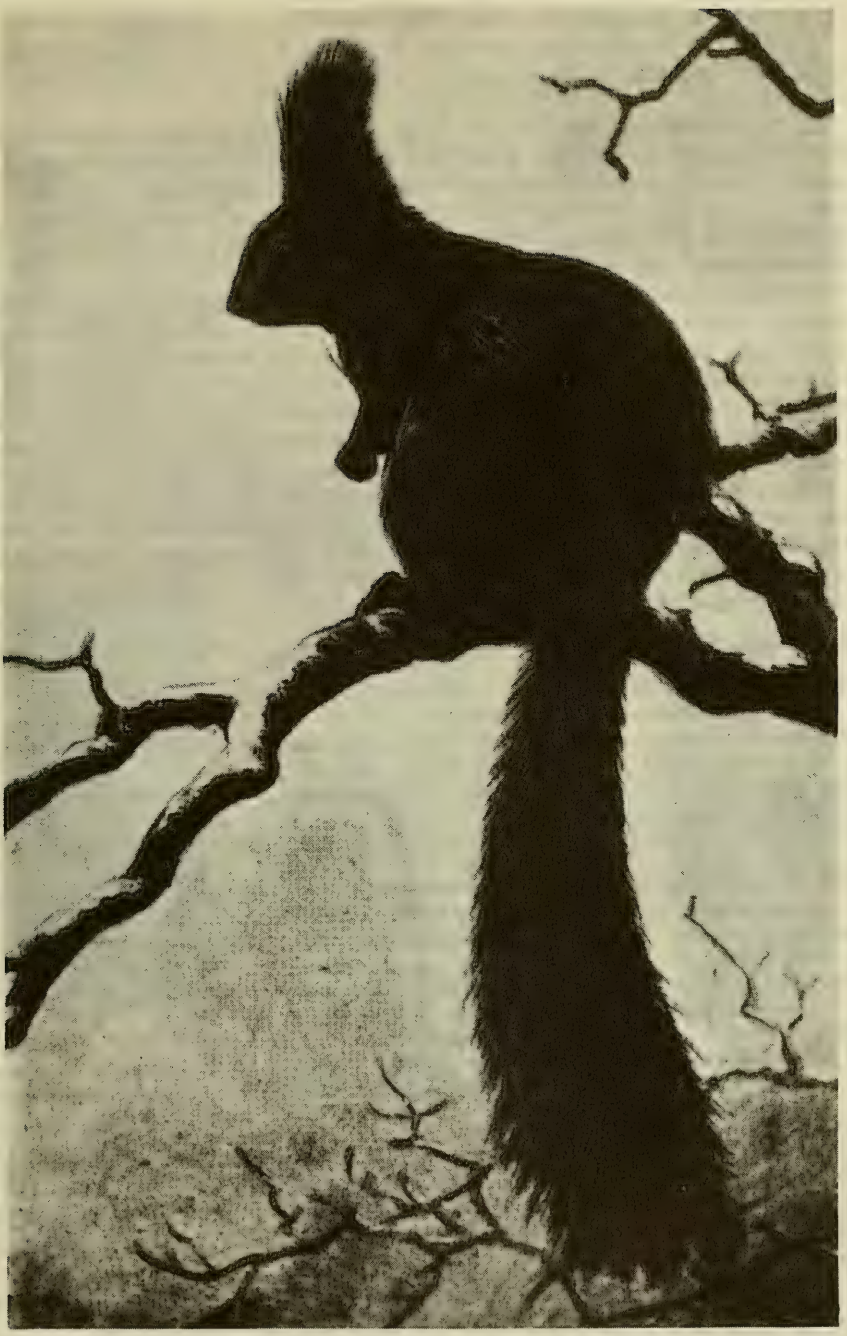
TYPE LOCALITY AND DEPOSITION. No. 621, female, May 1915, Sumy County of the Kharkov Province, Kiyanitsa Townlet. Type in the collection of the Kharkov Station for Plant Protection.

MATERIAL EXAMINED: 9 specimens.

DIAGNOSIS. Winter fur retaining marked brownish rust tones along the spine and in lower part of back. Tail brown-rust colored. Ears lighter, also brown-rust. Fur coarse, not luxuriant. Color of summer fur on back and tail rich ocher-red-rust.

MEASUREMENTS: Large; length of skull 53-53.4 mm; condylobasal length 48.2-50 mm; zygomatic width 29.2-32.6 mm; length of upper tooth row 10.1 mm; hind feet 59-61 mm; tail 160-200 mm.

DESCRIPTION. Winter fur (Plate VII) distinguished by a different intensity of gray. In the grayest specimens, back (except for the spine) dirty ash-gray (between mouse-gray and light neutral-gray) with fine chestnut-gray mottling. Brown-rust tones similar to cinnamon-pecan-brown or rufous-tawny well marked along spine, and in lower part of back. Spine also with well marked fine brownish rust mottling. Cheeks, forehead and occiput light gray-rust with dark gray mottling. Ears light brownish rust (cinnamon-rufous to pecan-brown). Brown-rust color also on feet. Dorsal side of tail brown-rust (between cinnamon-rufous-tawny and hazel). Medium line of ventral side with ash-gray hair roots.



Ukrainian rust-colored squirrel (Sciurus vulgaris ukrainicus Migulin). Winter fur
Drawing by V. A. Vatagin

Specimens with rust-brown tones occur together with gray specimens. Rust-brown tones well marked on back, especially along spine and on flanks. Gray color of flanks with a rust-buff tinge.

Winter fur differs from summer fur in well marked gray color of flanks. Ears with long hair tufts of pale brownish rust tone (cinnamon-rufous, pecan-brown).

Color of summer fur on back, legs and tail, saturated ocher-red-rust, between cinnamon-rufous, hazel and kaiser-brown. Color of flanks richer, lighter and more yellow. Nose and cheeks, sides of neck and chin, with grayish tones. Chest with white wedge, apex pointing anteriorly.

393 SYSTEMATIC NOTES. Differs from S. v. ognevi by its large size and brownish rust color of winter fur.

GEOGRAPHICAL DISTRIBUTION. Bryansk, Trubchevsk and Dmitrievsk forests, in the Poltava District, from Romny in the south to Krasnograd (apparently only rarely). It is also found in the former Izyum, Sumy and Zmiev counties of Kharkov Province. In the east this animal occurs in isolated localities, e.g., the Grafskaya forestry (north of Voronezh), the Khrenovsk forest. It was rare in the Shipov forest (former Pavlovsk County), and has now disappeared from there. According to D. Kapranov ("Hunter's Gazette" (Okhotonich'ya gazeta), No. 13, 1928, p. 5) several families were found in ravines in Ternovaya and Dashkina of the former Boguchar County of the Voronezh Province. This is the most southeastern record of S. v. ukrainicus.

364. Sciurus vulgaris kessleri Migulin (1928). Kessler's squirrel

1840. Sciurus vulgaris Nordmann A., Observations sur la Faune Pontique; in: A. Demidoff, Voyage dans la Russie méridionale, III, pp. 54-55.

1850. Sciurus vulgaris Kessler K. F., Zhivotnye gubernii Kievskogo uchebnogo okruga (Animals of the Provinces of the Kiev District), pp. 38-40.

1858. Sciurus vulgaris Belke G., Esquisse de l'Histoire Naturelle de Kamienietz-Podolski. Bulletin Naturel de Moscou, p. 26.

1877. Sciurus vulgaris Tacznowski L., Liste des Vertébrés de Pologne, Bulletin Zoologique de France, p. 129.

1915. Sciurus vulgaris Sharleman E. V., Mlekopitayushchie okrestnostei Kieva (Mammals of the Vicinity of Kiev), Izdatel'stvo Kievskogo ornitologicheskogo obshchestva, pp. 50-51.

1925-1926. Sciurus vulgaris fuscoater Khranevich V., Narys fauny Podillya (A Survey of the Podolian Fauna), pp. 21-22.

1927-1928. Sciurus vulgaris kessleri Migulin A. A., Obzor gryzunov Ukrainy (A Survey of Ukrainian Rodents), "Zakhist roslyn", Nos. 3-4, p. 12.

1930.-S (ciurus) v (ulgaris) kessleri and S. v. ukrainicus Danilovich A. P., O belkakh okrestnostei Kieva (Squirrels of the Vicinity of Kiev), "Okhotnik", March, Moscow, p. 20.

TYPE LOCALITY AND DEPOSITION. Vicinity of Zhitomir. Holotype in A. A. Migulin's collection.

MATERIAL EXAMINED: 40 specimens.

DIAGNOSIS. Winter fur of light specimens (spine and lower part of back) with rust-brown tones. Dark specimens with dark brownish rust tones. Tail rust-brown. Ears deep gray-chestnut with a light reddish tinge. The subspecies differs, in this respect, from S. v. ukrainicus, the ears of which are light (see above).

Fur coarse, not luxuriant. Summer fur on back and tail of two types: a) rich ocher-red-rust; b) saturated red-chestnut

MEASUREMENTS larger than in S. v. ukrainicus: Length of skull 51-55.2 mm (M. 53.7 mm); condylobasal length 48-52.8 mm (M. 49.5 mm);

zygomatic width 31-34.3 mm (M. 32.5 mm); length of upper tooth row 9.4-10.2 mm (M. 9.8 mm); hind feet 53-65 mm (M. 58 mm); tail 180-205 mm (M. 188 mm).

DESCRIPTION. Winter fur of two types: 1) light type. These specimens closely resemble the rust-brown type of S. v. ukrainicus Migul. (see above). S. v. kessleri, however, differs from S. v. ukrainicus in the darker color of the ears. The ears of S. v. kessleri are dark chestnut-gray with a light reddish tinge (natal-brown or benzo-brown, occasionally near fuscous) in darker specimens.

2) Dark type. Top of head, lower part of back and spine dark rust-brown (between russet and Prout's brown). Neck, shoulders and flanks with a marked gray tinge and brownish-chestnut mottling. Chin and sides of neck gray-buff (light-drab), differing from rust color of cheeks. Ear tufts fuscous, i.e., deep gray-chestnut with a light red tinge.

Feet rich rust-brown (of a purer shade than russet). Tail rust-brown (between russet and Prout's brown). Hair on tail with ash-gray-chestnut roots. Ventral side of tail like dorsal side. However, middle of ventral side with more marked gray shades.

Summer fur. In specimens of the light type, color like that of S. v. ukrainicus except for the ears, which are chestnut-gray. Top of head and back of dark squirrels saturated red-chestnut, between bay and chestnut. Flanks and legs lighter and redder, between ferruginous and kaiser-brown. Chin and sides of neck lighter, buff, clearly different from dull reddish chestnut-gray color of cheeks. Color of tail resembling that of back, a little redder and more rust colored. Ash-chestnut-gray hair roots well marked in median line of ventral side.

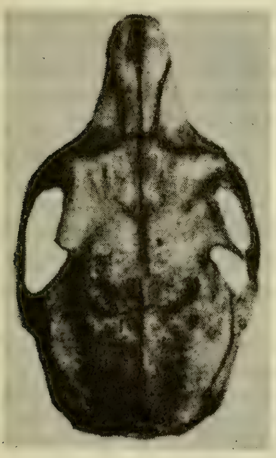


FIGURE 185. Skull of Sciurus vulgaris kessleri Migulin, No. M. 3704, from the former Kiev Province

SYSTEMATIC NOTES. S. v. ukrainicus and S. v. kessleri differ in series in a number of characters (see diagnosis).

The most constant character is the color of the ears. Those of S. v. kessleri are usually much darker than those of S. v. ukrainicus. A. P. Danilovich (1930) recorded both S. v. kessleri (5 specimens) and S. v. ukrainicus (2 specimens) near Kiev. This author probably considered light specimens of S. v. kessleri as ukrainicus. I examined a large series of S. v. kessleri and did not find a single ukrainicus among them. All specimens from the left-bank Ukraine proved to belong to typical ukrainicus.

395 Series of S. v. fuscoater Altum (type from Harz Mts., Germany) should be compared with S. v. kessleri to determine their relationship.

G. S. Miller (1912) gives a good description of S. v. fuscoater which shows that the winter fur of S. v. fuscoater differs from that of S. v. kessleri as follows: 1) light type — purer and richer reddish tone (rufous) with light buff-gray shades on the sides of the back (pale smoke-gray); 2) dark type — difference even more marked. Back of S. v. fuscoater chestnut, without any reddish brown tinge, with a gray tinge and a black tail. I never found black-tailed specimens of S. v. kessleri. S. v. kessleri seems therefore to be a well characterized form of S. v. fuscoater.

GEOGRAPHICAL DISTRIBUTION. Forests of the right bank of the Dnieper. It is found in the north in the Minsk and Gomel districts. It occurs throughout Podolia and the northern, forested part of Bessarabia. The southern boundary of the range is not known. It is found in isolated forests from Balta and Uman' up to Zvenigorodka and Cherkassy.

365. Sciurus vulgaris bashkiricus Ogn. (1935). Bashkirian squirrel

1928. Sciurus vulgaris exalbidus (partim!) Serebrennikov M., Synopsis of Russian Squirrels. Doklady Akademii Nauk SSSR, p. 424; Serebrennikov M. K., Materialy po sistematike i ekologii gryzunov yuzhnogo Zaural'ya (Materials on the Systematics and Ecology of the Rodents of East of the Southern Urals), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, 1929, pp. 280-281.

1935. Sciurus vulgaris bashkiricus Ognev S. I. Sistematicheskii obzor belok, vodyashchikhsya v SSSR (A Systematic Survey of Squirrels of the U. S. S. R.), Byulleten' Nauchno-issledovatel'skogo instituta zoologii Moskovskogo universiteta, No. 2, p. 46.

TYPE LOCALITY AND DEPOSITION. No. M. 3352, female, 25 November 1929, Buzuluk pine forest, Shkotovskoe forestry (former Buzuluk County of the Samara Province). Holotype in S. I. Ognev's collection.

MATERIAL EXAMINED: holotype and 14 paratypes.

DIAGNOSIS. Winter fur light, between pale whitish buff-gray to bluish gray. Winter fur always with gray mottling. Many specimens bald-spine, with buff-ocher tones along spine and on lower part of back. Ears between ocher-red and blackish or black-chestnut. Chestnut-tailed specimens common. Dark-tailed specimens rarer. Fur soft but not luxuriant. Summer fur without the intense color of northern or Moscow squirrels. Summer fur ocher-red-chestnut.

Skull larger than that of S. v. ognevi: Length of skull 51-54.7 mm (M. 53.2 mm); condylobasal length 47.3-48.7 mm (M. 48.2 mm); zygomatic width 31.2-34.2 mm (M. 33.2 mm); length of upper tooth row 9.2-10.2 mm (M. 9.7 mm); hind feet 51.3-57 mm (M. 52.8 mm); tail 164-208 mm (M. 185.6 mm).

DESCRIPTION. Winter fur uniformly light gray. Back of light specimens pale whitish gray with buff shade and gray mottling. Back between light gull-gray and pale smoke-gray. Lower part of back and occasionally spine with pale buff-ocher tones (bald-spine). In more
396 intensely colored specimens, back more bluish-gray (between gull-gray and smoke-gray) with gray mottling.

In light-colored specimens, sides of neck white. White area of belly unusually large, high on the flanks, to the shoulders, haunches and tibiae; top of head and occiput, forehead and cheeks with red-ocher tones. Nose buff-white with a weak ocher tinge. Ears red-ocher (orange-cinnamon). Tips of ears with black-chestnut tufts. Chestnut-tailed specimens common. Roots of hair on tail broad, pale whitish gray (pale smoke-gray), followed by pale straw-ocher subapical bands and black tips. Middle of ventral side of tail whitish. Ocher subapical bands of hair well marked, rich ocher-red (between orange-cinnamon and sayal-brown), the tips of hair black or black-chestnut. The tip of black or black-chestnut hair is yellowish buff, so that it appears mottled.

In light specimens, feet in winter fur rich, light reddish ocher.

Dark-colored squirrels (see above). Cheeks, forehead and occiput with a light yellowish buff tinge. Base of ears dull rust-buff, long hair on ears black or black-chestnut. Soles, forelegs and antebrachia in part with a dull rust-buff tinge.

Tail of the dark-tailed type. Hair of dorsal side with broad ash-gray roots (between gull-gray and deep gull-gray); hair tips black, so that the dorsal side appears dark. Middle of ventral side ash-gray, sides with a gray-buff tone in front of the zone with black hair tips.

Summer fur. Back ocher-red-chestnut (between tawny and cinnamon-rufous), generally purer and more reddish than in S. v. ognevi and S. v. varius.

Flanks and cheeks with reddish buff tones. Feet reddish ocher. Most squirrels examined in summer belonged to the chestnut-tailed type. Red-tailed specimens were rare.

SYSTEMATIC NOTES. The Bashkirian squirrel differs from the Moscow squirrel in its paler and lighter color. These differences are especially marked in winter specimens. S. v. bashkiricus is closely related to the Ural mountain squirrel (see below), but differs from it in the less pure gray color of the winter fur, the buff tinge on the back and ocher tinge on occiput. S. v. bashkiricus resembles the Teleut squirrel. M.K. Serebrennikov (1928, 1929) considers the Bashkirian squirrel as identical with the Teleut squirrel. However, S. v. bashkiricus is much smaller 397 and more short-tailed than the Teleut squirrel. Furthermore, Bashkirian squirrels never have gray tails, which are typical for the Teleut squirrel.

GEOGRAPHICAL DISTRIBUTION. Buzuluk pine forest and forests of Bashkiria, to the middle reaches of the Belaya river in the north. This region is inhabited by a type intermediate between S. v. bashkiricus and S. v. ognevi.

365'. Sciurus vulgaris bashkiricus natio uralensis Ogn. (1935). Ural mountain squirrel

1874. Sciurus vulgaris Sabaneev L. P., Pozvonochnye srednego Urala (Vertebrates of the Central Urals), p. 9.

1897. Sciurus vulgaris Zarudnyi N., Zametki po faune mlekopitayushchikh Orenburgskogo kraya (Notes on the Mammal Fauna of the Orenburg Territory), p. 2.

1928. Sciurus vulgaris varius Dulkel'skaya N. M., Opyt obzora fauny mlekopitayushchikh Il'menskogo zapovednika (A Survey of the Mammalian Fauna of the Il'menskii Reserve), pp. 26-28.

1935. Sciurus vulgaris bashkiricus natio uralensis Ognev S. I., Sistematicheskii obzor belok, vodyashchikhsya v SSSR (A Systematic Survey of the Squirrels of the U. S. S. R.), Byulleten' Nauchno-Issledovatel'skogo instituta zoologii Moskovskogo universiteta, No. 2, p. 46.

TYPE LOCALITY AND DEPOSITION. No. M. 1650, sex unknown, December 1926, Miass of the Zlatoust District (former County of the Orenburg Province), Il'menskie Mountains, S. I. Snigirevskii.

MATERIAL EXAMINED: holotype and 13 paratypes.

DIAGNOSIS. Closely related to S. v. bashkiricus, but differing from it in the purer gray color of the back. In winter fur, back bluish smoke-gray (deep gull-gray) with a light buff-gray tinge (smoke-gray). Color of head and occiput like that of back. Base of ears smoke-gray. Tufts on ears black or black-chestnut. Tail of the chestnut or dark-chestnut type.

Summer fur resembling that of S. v. bashkiricus, but more chestnut-yellow, without the rust-red tones characteristic of S. v. bashkiricus.

Measurements like those of the Bashkirian squirrel.

SYSTEMATIC NOTES. Closely related to S. v. bashkiricus, transitional to West Siberian squirrels. The winter fur differs from that of S. v. martensi in being less luxuriant and in having a more intense gray color of the back. S. v. martensi is larger than the Ural squirrel (see below).

GEOGRAPHICAL DISTRIBUTION. Central Urals, in the northern parts and on its eastern slopes. I have specimens from the Nyays' river (eastern slopes of Northern Urals). Their summer fur resembles that of the central Ural squirrels.

366. Sciurus vulgaris martensi Matschie (1901). West Siberian squirrel

?1792. Sciurus vulgaris argenteus Kerr R., Animal Kingdom, p. 256 (terra typica not indicated).

1804. Sciurus vulgaris albus Dvigubski J., Prodromus Faunae Rossicae, p. 86 (partim!) ("In deserto Barabensi ad fl. Samaram Obum, ad Baikalum... ").

398 1904. Sciurus martensi Matschie P., Zoographische Betrachtungen über die Säugetiere der nördlichen Alten Welt. Arch. f. Naturgesch., Beiheft zu Bd. 67, S. 313.

1915. Sciurus vulgaris Chugunov S. M., Mlekopitayushchie i ptitsy Surgutskogo uezda (Mammals and Birds of the Surgut County), Ezhegodnik Tobol'skogo gubernskogo muzeya, XXIV, pp. 32-33.

1928. Sciurus vulgaris nadymensis Serebrennikov M., Synopsis of Russian Squirrels, Akademiya Nauk SSSR, p. 422.

TYPE LOCALITY. Sciurus martensi was described by P. Matschie from the left bank of the lower Yenisei.

This so-called "species", which is in fact a subspecies of S. vulgaris, was described on the basis of A. Middendorf's work "Sibirische Reise", Säugethiere, Vögel und Amphibien, St. Petersb., 1867, S. 80. Middendorf gives a description of the light form, indicating that it occurs along the left bank of the Yenisei and along its right bank between the Stony Tunguska and the Polar Circle.

Middendorf writes: "Die gewöhnliche Färbung der Eichhörnchen am unteren Jenisej, zwischen der Stein-Tunguska und Polarkreise, zumal auf dem linken Ufer des Stromes, ist ein helles Grau, welches um eine, nur bei dem genauesten Vergleiche in die Augen fallende, Tinte heller ist als das Grau der baltischen Eichhörnchen. Bei näherer Untersuchung findet sich dann, dass das Grau der Jenisej Eichhörnchen deswegen heller erscheint, weil das Weiss, welches jederseits die schwarze Binde jedes Deck-haares begrenzt, ein reines Weiss ist, und keine Spur einer gelblichen Tinte verräth."

The author stressed that this squirrel is chestnut-tailed and that its ear tufts are chestnut-black. The above quotation shows that it is based on light specimens which inhabit the left bank of the Yenisei. On p. 81 Middendorf says that squirrels from the right bank of the Yenisei are darker: "Auf dem rechten Ufer des Jenisej sind, wie oben angeführt, die Bälge dunkler... "

M. K. Serebrennikov's assumption that the description of martensi applies to dark specimens from the right bank of the Yenisei is therefore erroneous (see below)

Middendorf's type of martensi is apparently lost.

MATERIAL EXAMINED: 119 specimens.

DIAGNOSIS. Winter fur on back very light buff-gray with light grayish mottling. Specimens of a more intense gray color are rare. Bald-spine specimens are also rare. If a bald-spine is present, it is little marked on the lower part of back near the tail. Tail of chestnut type. Dark-tailed specimens are rare, red-tailed specimens very rare (see below). Winter fur luxuriant and silky. Summer fur of most specimens light, ocher-yellow-red, sometimes buff-yellow-gray, rarely darker, red-brown-ocher. Fur usually tricolored because of the presence of the light buff-ocher color of the flanks. White area of belly large: inner sides of hind legs and antebrachia, sides of neck and groin white.

Length of skull 51-55.8 mm (M. 52.4 mm); condylobasal length 46-51.2 mm (M. 47.2 mm); zygomatic width 29.5-32.8 mm (M. 30.4 mm); length of upper tooth row 9-10 mm (M. 9.3 mm); hind feet 52.1-61.1 mm (M. 57.9 mm); tail 145-192 mm (M. 166.1 mm).

DESCRIPTION. Color of winter fur more or less constant. Back very light buff-gray (light mouse-gray) with dense but weak gray mottling. Some deviations from this typical color type of the Ob squirrels occur, such as more intense gray tones (towards light neutral-gray and neutral-
399 gray). Color of flanks even lighter, pale gray with a light buff tinge. In full winter fur, top of head light buff-gray, cheeks pale buff-gray and ears black. Tail generally of chestnut type. The hairs have ash-gray roots, rust-brown subapical bands and broad black or black-chestnut tips. Some hairs on the tail, especially near its end, have brownish rust tips. The rust tones on the tail disappear in dark-tailed specimens, and only ash-gray roots and black-chestnut tips remain.

Color of summer fur very variable, but most specimens have a rather light color. Back of adult and old squirrels generally light ocher-yellow-red (tawny with a light reddish and yellow tinge). Nose and anterior part of head buff-gray-white. Cheeks also with a light buff tinge. Reddish ocher tones predominating on occiput. The subspecies is characterized by the very light, well marked buff-ocher (ochraceous-buff) color of the flanks sharply contrasting with the white underparts. The animal is therefore tricolored. Legs rich ocher-red-yellow. Tail generally chestnut (see above).

The light-colored type includes specimens with buff-yellow-gray back with a light red tinge in summer (ochraceous-tawny with a tawny shade). Anterior part of head and nose with many whitish hairs. Feet ocher-yellow. Flanks with a stripe of pale yellow-ocher fur (light ochraceous-buff) causing it to appear tricolored.

The dark-colored type includes a smaller number of intense chestnut-ochraceous colored squirrels, the backs of which are between kaiser-brown and hazel. Color of head more intense than in preceding forms, without a buff tinge. Flanks with well marked yellowish ocher fringes.

Color of young generally more yellow and lighter than of adults. Back of very young squirrels often dull buff-gray with a light ocher tinge.

SYSTEMATIC NOTES. Kerr (1792) mentioned Sciurus vulgaris argenteus ("silvery common squirrel") with the following description: "is larger than the ordinary varietas and of a glossy silver-gray color". He did not indicate the type locality. It may be assumed that his material consisted of West Siberian squirrels, the winter fur of which has these characters. I. Dwigubski (1804) mentioned Sciurus vulgaris albus, which is in part a synonym of martensi, as the Ob is mentioned as one of its habitats.

The confused synonymy of S. v. martensi with S. v. nadymensis is discussed above.

The West Siberian squirrel is closely related to S. v. bashkiricus natio uralensis, and differs from it as follows: 1) lighter buff tone of back in winter specimens; 2) more luxuriant fur; 3) large size.

400 It was stated above that chestnut-tailed squirrels predominate among West Siberian squirrels. I. D. Kiris collected a large series of squirrels from Surgut. He estimated the percentage of color types and found the following:

I.	Dark chestnut-tailed	3.7%	(4)
II.	Chestnut-tailed	93.5%	(102)
	typical chestnut-tailed	62%	(68)
	light chestnut-tailed	31.1%	(34)
III.	Red-tailed	2.8%	(3)

The tails of some very young squirrels resemble those of chipmunks, as the hair is not fully grown. Such young specimens show a greater percentage of red-tailed specimens. The following figures were obtained:

I. Chestnut-tailed	72.2%	(13)
typical chestnut-tailed	5.5%	(1)
light chestnut-tailed	66.7%	(12)
II. Red-tailed	27.8%	(5)

These data show that the age of the squirrel is an important factor in descriptions.

S. v. martensi apparently forms a separate natio in the southern part of of its range, which is transitional to the Teleut squirrel. Squirrels between Novosibirsk and Narym have gray tails, but there are also chestnut-tailed specimens with a gray tone on the tail.

These squirrels are intermediate between the Teleut squirrel and S. v. martensi in some respects. In the Tomsk-Novosibirsk region, and also north and southeast of this region, there are many light chestnut-tailed squirrels with marked rust tones on the tail and with red-rust-colored ears. The winter fur of these squirrels is very light, pale buff-gray with weak mottling. I cannot determine the systematic position of these specimens at present, for lack of material.

The furriers consider these squirrels as a separate Tomsk strain. According to B.A. Kuznetsov (in litt., 1935), there are no black-tailed or dark-tailed specimens in this strain, which consists mainly of chestnut-tailed specimens, of both dark and light types. A few specimens have red tails. B.A. Kuznetsov examined 96,581 pelts and found the following:

Dark-tailed	49%
Chestnut-tailed	44%
Red-tailed	7%

The Tomsk strain is apparently an intermediate form (natio) between martensi and altaicus (?).

Further study will show whether these squirrels deserve a separate name.

GEOGRAPHICAL DISTRIBUTION. A large part of West Siberia in the middle and lower reaches of the Ob and along the Narym. The subspecies
401 reaches the Yenisei in the east. The light-colored squirrels gradually disappear on the right bank of this river, and are replaced by the darker subspecies. The southern limit of the range of S. v. martensi is not exactly known. It is also not known which form occurs in the Tara region, between Narym and Tomsk and near Novosibirsk.

367. Sciurus vulgaris exalbidus Pallas (1778). Teleut squirrel

1788. Sciurus vulgaris varietas exalbida Pallas P., Novae Species Quadrupedum e Glirium ordine, p. 374.

1792. Teleutskaja belka or Squirrel of the Teleutian tartars. Kerr R., Animal Kingdom, p. 256 (Upper parts of the Ob).

1811-1831. Sciurus varius (partim!) Pallas P., Zoographia Rosso-Asiatica, pp. 183-185.

1911. S(ciurus) Talahutky Brass E., Aus dem Reiche der Pelze, S. 586 (South Siberia).

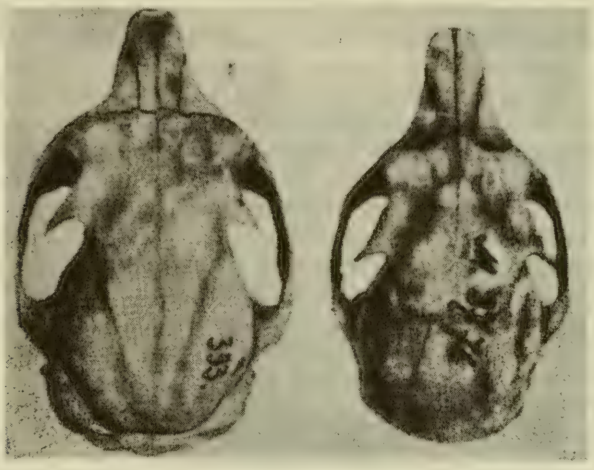
1923. Sciurus vulgaris Martino V. and E., Materialy po sistematike i geograficheskomu rasprostraneniyu mlekopitayushchikh Kirgizskoi stepi (Materials on the Systematics and Geographical Distribution of Mammals of the Kirghiz Steppe), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XXIV, pp. 21-22.

1928. Sciurus vulgaris exalbidus Serebrennikov M., Synopsis of Russian squirrels, Doklady Akademii Nauk.

TYPE LOCALITY AND DEPOSITION. Described by Pallas from a specimen from the region of isolated pine forests along the Irtysh and Ob. Type lost.

MATERIAL EXAMINED: 210 specimens.

DIAGNOSIS. Winter fur light buff-gray with grayish mottling. The following variations occur: 1) darker color of back. The dark specimens of the Teleut squirrel are, however, much lighter than dark S. v. martensi. 2) albinism. These whitish squirrels usually show yellowish buff bald-spine. Tail of most specimens pale gray with a blackish gray tinge and usually very pale yellowish rust shades. Chestnut- and dark-tailed specimens never occur. Hair of winter fur very long and dense.



FIGURES 186, 187. Left, skull of Sciurus vulgaris exalbidus Pallas, No. 333 female, Korosten forestry, West Siberia, G. K. Gol'tsmaier. Right, skull of Sciurus vulgaris rupestris Thos., No. M.3776, Sakhalin

Summer fur usually light, between pale ocher-yellow and more saturated orange-ocher. White area of belly large. Inner sides of hind legs and antebrachia white. The white color reaches far along the sides of the neck. Groin white.

402 Size very large: length of skull 54.6-59.2 mm (M. 56.9 mm); condylobasal length 50-53.2 mm (M. 52 mm); zygomatic width 33.1-36 mm (M. 34.9 mm); length of upper tooth row 10-11.1 mm (M. 10.4 mm); hind feet 56.1-65.5 mm (M. 62.9 mm); tail 153.2-222 mm (M. 196.2 mm).

DESCRIPTION. Winter fur. Back light buff-gray with dense, well marked mottling which is not dark gray. Back pale mouse-gray. Color of flanks lighter, palid mouse-gray. Mottling practically absent on flanks. Hair of belly white, without gray roots. Outer parts of shoulders and haunches lighter than back (between pale mouse-gray and pallid mouse-gray). Forehead and occiput gray with a slight rust tinge. Anterior part of forehead, cheeks and region around the eyes pale yellowish buff-rust (light pinkish cinnamon) with a light cinnamon tinge which is especially marked in the middle of the muzzle. Tufts of ears luxuriant, ocher-red-rust (orange-cinnamon). Feet more rust colored and richer than the ears (pinkish cinnamon). Tail very long and luxuriant, gray, generally pale mouse-gray with a blackish gray tinge and yellowish buff hair tips. Color of hair on tail of typical specimens as follows: roots broadly whitish gray (pallid mouse-gray), followed by black bands which are well marked on the sides, and pale yellow-buff (pinkish buff) hair tips. Whitish roots of hair clearly marked in the middle of the ventral side of the tail.

The above is a description of typical Teleut squirrels. The color of the winter fur is very constant, with only the following small variations.

Dark-colored type. General color of back more intense, not so buff, more bluish (between pale mouse-gray and light mouse-gray with a pallid neutral-gray tinge) and with a fine, more yellow-gray mottling. Flanks lighter than back. Belly pure white. Color of head like that of preceding type, but the gray tones are generally more intense. Tufts of ears luxuriant, dark chestnut-brown (between mikado-brown and verona-brown). Soles rust-yellow (cinnamon). Outer parts of hind soles with broad black fringe. Tail gray with well marked black hair tips. Color of hair on tail as follows: roots broadly light gray (pale mouse-gray); hair tips long, black-chestnut or black. Terminal hair of tail with light gray roots, dull yellowish buff bands, blackish subapical bands and yellowish buff tips.

The light-colored type shows a tendency towards albinism. Back whitish gray with a buff tinge, which is especially marked along the middle of the spine (pale drab-gray or even more whitish). Muzzle, region around the eyes and forehead very light, yellowish buff (light pinkish cinnamon); 403 flanks whitish, belly pure white, feet light, yellowish rust colored (between light pinkish cinnamon and pinkish cinnamon). Ears light ocher-rust colored (between pinkish cinnamon and vinaceous-cinnamon). Roots of hair on tail mainly whitish gray, followed by narrow pale dull yellowish buff bands, gray-black subapical bands and pale rust-buff tips. Terminal hair of tail without gray-black bands, only with broad dull rust-buff tips. This combination results in a pale gray-buff color.

Summer fur. Back of full grown specimens between pale ocher-yellow-rust (pinkish cinnamon to cinnamon) and darker orange-ocher (orange-cinnamon), sometimes chestnut-ocher (mikado-brown). Head usually lighter and more yellow than back. Color of ears like that of back, sometimes darker. Flanks light yellowish with a rust tinge (cinnamon-buff to pinkish-cinnamon). Color of feet similar to that of back. Color of tail variable, generally whitish gray in lighter specimens, with yellowish buff and dark gray shades caused by bands of these colors. Tip of tail pale yellowish buff. In darker specimens tail more ash-gray with well marked black-gray hair tips. There are also squirrels with pale gray tails darkened on the upper part by blackish hair and having almost pure white tips.

Color of young squirrels duller, lighter and yellower than that of adults. Color of back of young between cinnamon and pinkish cinnamon. Tail of young usually pale gray with a well marked yellowish rust tone, especially near the tip.

SYSTEMATIC NOTES. This subspecies is well characterized. It is the largest subspecies. The tail is pale gray. The Teleut squirrel is a link in the chain of West Siberian squirrels. Its color generally closely resembles that of S. v. bashkiricus, but the two are not identical. It does not reach the Volga, as M.K. Serebrennikov (1928) thought. The Teleut squirrel is also closely related to S. v. martensi. It is easily distinguished from these subspecies by its large size and long tail. We stated above that a transitional type between martensi and exalbidus occurs between Novosibirsk, Tomsk and Narym. Specimens from Novosibirsk in my collection resemble Teleut squirrels, but their ear tufts are black. This was never seen in true S. v. exalbidus. More material on the Tomsk squirrels should be collected, so as to be able to determine their relationship to squirrels in the Kalba Range, which were recently described by V.A. Selevin (1934) as a separate race.

GEOGRAPHICAL DISTRIBUTION. The Teleut squirrel mainly occurs in pine forests along the right bank of the Ob, between Biisk and Novosibirsk. It is also found in narrow strips of pine forests in the Kulundin Steppe.
404 Some of these pine forests, e.g., the Burlin forest, are north of the Kamen' and the Teleut - Gorkoe lakes. Farther southwest the Teleut squirrel occurs in "ribbon" pine forests along the Irtysh (near Semipalatinsk and east and west of this town). The ribbon pine forests along the Irtysh include the Loktevskii, Shul'binskii, Korostelevskii, Srostinskii and Severnyi pine forests.

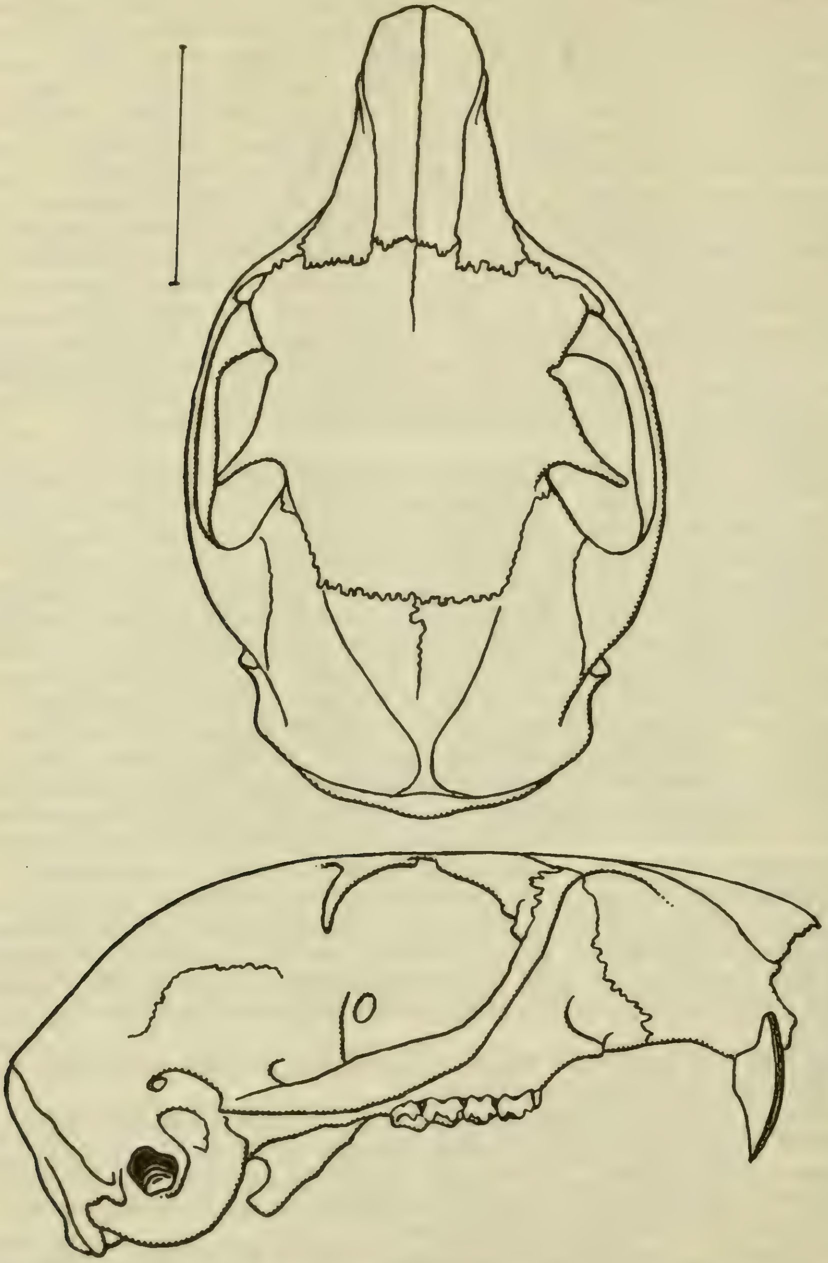
The northern boundary of the range of the Teleut squirrel is not known exactly. G.K. Gol'tsmaier (1935) assumes that the northwestern boundary follows the line Sverdlovsk - Chelyabinsk - Kurgan. In my opinion, the Teleut squirrel does not occur there, but is replaced by the Ural squirrel on the Urals as far as Sverdlovsk and apparently by the Bashkirian squirrel in the Chelyabinsk District. Farther east, near Novosibirsk, the range of the Teleut squirrel joins that of the West Siberian squirrel (S. v. martensi or a related form) which occurs north of the town, while the Teleut squirrel is found in adjacent pine forests, south of the town. From Novosibirsk
405 the boundary turns southeast and follows the forest steppe which separates the pine forests along the Ob from the forests of the Salair Range. The boundary then crosses the Biya river above Biisk, along the line connecting the village of Karabinskoe with the estuary of the Kazh river (a left tributary of the Biya). According to S. N. Korchev, the Teleut squirrel occurs in small numbers further along the river Biya, along its tributary Lebed', in small pine forests along these rivers, in the lower reaches of the Baigol (a tributary of the Lebed') and its tributary, the Klyk. The occurrence of the Teleut squirrel along the Baigol and Klyk rivers is of special interest. It inhabits isolated pine forests in the Altai taiga among cedar and spruce forests, in which the Altai squirrel occurs; their ranges are adjacent and partly overlapping.

Pallas was thus apparently wrong in stating that the Teleut squirrel occurs along the Chulym to the Yenisei.

We have no exact data on the distribution of the Teleut squirrel in the pine forests west of the Irtysh, towards Pavlodar and Kokchetav. G.K. Gol'tsmaier (1935) writes: "At present, the Teleut squirrel does not occur farther east in the pine forest near Karkaralinsk, on the Kokche-Tau or along the upper reaches of the Tobol river."

N.M. Mikhel' ("Trudy Kazakhskoi bazy Akademii Nauk SSSR", 1934, pp. 35-51) does not record the Teleut squirrel from the Borovskii forest. A.M. Belyaev ("A List of the Mammals of Kazakhstan" (Spisok gryzunov Kazakhstana), Trudy Zoologicheskogo instituta Akademii Nauk, II, 1934,

p. 30) states that the Teleut squirrel is a "foreigner" in the pine forests of the former Kokchetav County.



FIGURES 188, 189. Skull of Sciurus vulgaris exalbidus Pall., No. M.3906, female, 25 Nov. 1931, Srostinskii pine forest, former Zmeinogorsk County of the Tomsk Province.
Drawing by Yu. A. Kostylev

In September 1933 N.A. Bobrinskii and S.A. Severtsov caught two Teleut squirrels* in an oak-birch forest, 50 km southwest of Kokchetav. It seems that the animal occurs rarely in this region.

368. Sciurus vulgaris kalbinensis Selevin (1934). "Borovushka" or the Kalba squirrel

1934. Sciurus vulgaris kalbinensis Selevin V. A., Predvaritel'noe opisanie novykh form gryzunov iz Kazakhstana (A Preliminary Description of New Forms of Rodents from Kazakhstan), Byulleten' Sredneaziatskogo gosudarstvennogo universiteta, 19(13): 75.

TYPE LOCALITY AND DEPOSITION. Collected 30 Dec. 1931, Ayudin pine forest on the southern slope of the Kalba Altai. Type (No. 3, adult) in V. A. Selevin's collection.

MATERIAL EXAMINED: I have, unfortunately, not seen any material. Selevin does not state the number of specimens examined.

DIAGNOSIS (after V.A. Selevin): "Color similar to that of Sciurus vulgaris exalbidus Pall., but slightly darker and grayer in winter fur. Distribution of color areas as in the Teleut squirrel. Winter fur of adult specimens often with traces of bald-spine, i.e., rust-colored spots on posterior part of back. This is a juvenile character in S. v. exalbidus.
406 Color of tail differs sharply from that of the Teleut squirrel, it is rich rust, rarely chestnut, while the tail of the Teleut squirrel is always gray**. When the tail of the Kalba squirrel is chestnut colored, the whole animal is darker. S. v. kalbinensis, therefore, apparently has different color types, including light rust-tailed and dark chestnut-tailed forms. Its skull measurements are intermediate between those of the Altai and the Teleut squirrel. Condylobasal length 49.5-50 mm; zygomatic width 32.0-34.5 mm."

SYSTEMATIC NOTES. It is difficult to determine the differences between S. v. kalbinensis and its geographical neighbours from V.A. Selevin's short description. It certainly differs from the Teleut squirrel to judge from the description.

The differences between the Kalba squirrel and the Teleut squirrel were mentioned before the publication of V.A. Selevin's description (B.A. Kuznetsov, "Rodents of the Semipalatinsk District" (Gryzuny Semipalatinskogo okruga), Byulleten' Moskovskogo obshchestva ispytatelei prirody, XLI (1-2): 80-81. 1932). Kuznetsov writes: "The second form found in pine forests of the Kalba Range differs from the Altai specimens as follows: 1) larger size; 2) back light silver-gray in winter fur and rich rust in summer fur; 3) tail of an intense red color. To judge from pelts, the Kalba squirrel is a separate, so far undescribed subspecies."

A comparison between S. v. kalbinensis and squirrels from the Tomsk Territory (see above) would be interesting.

GEOGRAPHICAL DISTRIBUTION. Pine forests on the southern slopes of the Kalba Altai.

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* It is difficult to decide whether squirrels from forests near Kokchetav are identical with the true Teleut squirrel (the latter is probably larger).

** This is not correct (see above).

369. Sciurus vulgaris jenissejensis Ogn. (1935). Yenisei squirrel

1867. Sciurus vulgaris Middendorf A. Th., Sibirische Reise, Säugethiere, S. 78-83.

1880. Sciurus vulgaris Tel (in Nordenskjöld's book), Ekspeditsiya k ust'yu Eniseya (An Expedition to the Estuary of the Yenisei), p. 178.

1920. Sciurus vulgaris Solov'ev D. K., Sayanskii promyslovo-okhotnichii raion (The Sayan Commercial-Hunting District), pp. 255-257.

1924. Sciurus vulgaris Kozhanchikov L. and I., Promyslovaya okhota i rybolovstvo v Minusinskoi taige (Commercial Hunting and Fishing in the Minusinsk Taiga), Ezhegodnik Gosudarstvennogo muzeya imeni Mart'yanova, II (2): 131-136.

1925. Sciurus vulgaris and Sciurus vulgaris calotus Shukhov I. I., Obzor rasprostraneniya okhotnich'ikh i promyslovykh mlekopitayushchikh v Eniseiskoi gubernii, Turkestanskom krae i v Uryankhaiskoi zemle (A Survey of Game and Commercial Mammals of the Yeniseisk Province, Turkestan Territory and the Urianghai Land), p. 15.

1930. Sciurus vulgaris martensis (sic!) Zverev M. D., Obzor gryzunov yuzhnykh chastei Minusinsko-Khakasskogo okruga (A Survey of the Rodents of the Southern Part of the Minusinsk-Khakassian District), Sbornik Srednesibirskogo geograficheskogo obshchestva, p. 83.

1930. Sciurus vulgaris subsp. Yakovlev E. O., K granitsam rasprostraneniya promyslovykh zverei i ptits v Turukhanskom krae (Ranges of Commercial Mammals and Birds in the Turukhansk Territory), Trudy Zoologicheskoi sektsii Srednesibirskogo geograficheskogo obshchestva, Issue 1, p. 57; Pogudin A. A., Ocherk okhotnich'ego promysla Kirenskogo okruga (A Survey of Commercial Hunting in the Kirensk District), Trudy Lesnoi opytnoi stantsii, Issue VII, 1930, p. 95.

1935. Sciurus vulgaris jenissejensis Ognev S. I., Sistematicheskii obzor belok (A Systematic Survey of Squirrels), Byulleten' Nauchno-issledovatel'skogo instituta zoologii Moskovskogo universiteta, No. 2, p. 47.

TYPE LOCALITY AND DEPOSITION. No. 75 male, 23 Oct. 1926. Lower Tunguska, Turukhansk Territory, N. P. Naumov. Type in the MSZM collection.

407 MATERIAL EXAMINED: Holotype and 340 skulls and pelts. Forty of the pelts examined were with skulls.

DIAGNOSIS. Color very variable. The most typical color of the winter fur is an intense bluish ash-gray with slight dark gray mottling. Tail generally reddish rust-chestnut with a marked black tinge. There are also a few red-tailed, dark-tailed and chestnut-tailed specimens. Winter fur on back very light ash-gray in red-tailed specimens. Summer fur of three types: 1) Back black-gray-chestnut; 2) Back dark chestnut; 3) rich rust-red-ocher specimens. White area of belly much reduced. Groin and inner sides of legs of dark color, not white.

Length of skull 51.3-53.7 mm (M. 51.9 mm); condylobasal length 45.1-49.2 mm (M. 47.2 mm); zygomatic width 29.2-32.2 mm (M. 30.6 mm); length of upper tooth row 9.1-10 mm (M. 9.5 mm); hind feet 56-62.5 mm (M. 58.8 mm); tail 165-191 mm (M. 172.2 mm).

DESCRIPTION. Color of winter fur very variable. Most specimens of this subspecies have a characteristic color of the tail which is transitional between the red and chestnut types (see below). In typical specimens the color of the winter fur on the back is an intense bluish ash-gray (light neutral-gray and neutral-gray) with fine dark gray mottling. Color of hair roots on back deep slate-gray (deep neutral-slate-gray), more intense than in S. v. martensi. Gray color of anterior part of head, nose, forehead and cheeks with a buff-rust tinge (between wood-brown, buff-brown and drab). Buff-gray shades at the sides of throat. Middle of throat with a white wedge. Color of ears between intense ocher-brown (kaiser-brown) and black. Gray color of back sharply contrasting with white color of belly, which is generally much less than in S. v. martensi, as the inner parts of the haunches and antebrachia are gray. Soles dark blackish gray.

Tail generally reddish rust-chestnut with marked black or deep black-chestnut tones. Color of hair on tail as follows: roots smoky blue-gray (light neutral-gray), followed by broad rust-brown bands (kaiser-brown, hazel) and by broad and well marked black or black-chestnut bands and rust colored tips which are especially marked towards the tip. Tail of specimens with rust-colored ears usually more rust colored than in dark- and black-eared specimens. There are all possible transitions to dark-chestnut-tailed and dark-tailed specimens. In these squirrels the color of the back is usually more intensely gray than in red-tailed and chestnut-tailed specimens; color of back intermediate between mouse-gray and neutral-gray.

408 The color of the tail varies between dark red and dark brown. Together with these squirrels occur red-tailed specimens, with a light ash-buff-gray back. Ears and tail rich rust-yellow-ocher (between tawny, sayal-brown and mikado-brown). Roots of hair on tail pale ash-gray (light mouse-gray), followed by broad rust-colored bands. Tips buff-yellow with a light ocher tinge (cinnamon-buff). These specimens closely resemble S. v. martensi in their light color, but differ from it in the smaller white area on the belly. Inner sides of hind legs and antebrachia light gray with a light buff-rust tinge.

Summer fur of three types: 1) darkest specimens. Color of back intense black-gray (between fuscous-black and fuscous), flanks a little grayer than back (between fuscous and chaetura-drab). Anterior part of head and cheeks with a slight gray tinge. Feet black-chestnut. Tail of chestnut or dark type. I did not see any black-tailed specimens in summer. 2) dark-chestnut specimens (apparently the most common type of summer fur). Back generally dull dark chestnut (slightly more brown than natal-brown). Head and cheeks with a buff-gray tinge. Feet deep chestnut-black-brown. Flanks with a dark gray-chestnut transition zone between white color of belly and brown color of back. Tail of chestnut and dark-red type (see above). 3) very light specimens. Color rich rust-red-ocher (between tawny-russet and mikado-brown). Sides of neck with a light yellowish ocher stripe. Tail of the true red-tailed type.

B. A. Kuznetsov (in litt., 1935) examined 146,464 pelts obtained by hunters and found that the Yenisei squirrels fall into the following groups, according to the color of the tail: 36% black tailed and dark tailed, 46% chestnut tailed, and about 18% red tailed.

SYSTEMATIC NOTES. Dark specimens of the Yenisei squirrel differ clearly from dark specimens of S. v. martensi. Light specimens of the Yenisei squirrel resemble light specimens of martensi, but can be recognized by the smaller white area of the belly, dark inguinal region and dark inner sides of legs. The differences from S. v. jacutensis will be given in the description of this subspecies.

The squirrels from Sayan-Minusinsk are closely related to S. v. jenissejensis. They differ from it only in their smaller size and less luxuriant fur (especially on the tail). The Sayan squirrels are thus apparently identical with the Altai form (see below).

GEOGRAPHICAL DISTRIBUTION. Along the left bank of the Yenisei, reaching the line Krasnoyarsk - Irkutsk in the south. The eastern boundary
409 is not known, as the region of Kirensk, Vitim, Vilyui is inhabited by squirrels which differ from S. v. jenissejensis but are not identical with S. v. jacutensis (see below).

370. Sciurus vulgaris altaicus Serebren. (1928). Altai squirrel

1884. Sciurus vulgaris Nikol'skii A. M., Puteshestvie v Altaiskie gory (A Journey to the Altai Mountains), Trudy Sankt-Peterburgskogo obshchestva estestvoispytatelie, XI, p. 174.

1899. Sciurus vulgaris Kashchenko N. F., Rezul'taty Altaiskoi ekspeditsii (Results of an Expedition to the Altai), Tomsk, p. 60.

1928. Sciurus vulgaris martensi natio altaicus Serebrennikov M., Synopsis of Russian Squirrels, Comptes Rendus de l'Academie de Sciences de l' U. R. R. S., p. 422.

TYPE LOCALITY AND DEPOSITION. Altai Mountains, Kok-Su river, estuary of the Yamanuch river. Type No. 10,075 in the ZMAN collection.

MATERIAL EXAMINED: 64 specimens.

DIAGNOSIS. Color very variable. The variations resemble those of S. v. jenissejensis. Dark- and black-tailed Altai squirrels are darker than dark S. v. jenissejensis. Other color types of the two subspecies are practically identical. There are fewer red-tailed specimens than in the Yenisei subspecies.

MEASUREMENTS smaller than in S. v. jenissejensis. Length of skull 49-53.1 mm (M. 50.9 mm); condylobassal length 45-48.5 mm (M. 46.4 mm); zygomatic width 28-31 mm (M. 29.8 mm); length of upper tooth row 8.8-8.9 mm; hind foot 45-60 mm (65 in one out of twenty) (M. 53.5 mm); tail 140-170 mm (M. 157.4 mm).

DESCRIPTION. Color of winter fur. The Altai squirrel resembles the Yenisei form in the variety of its color types. It differs from it in its darker color in series. Dark-tailed squirrels especially differ clearly. Back of the typical dark-tailed Altai squirrel dark gray (deep mouse-gray) with fine dark gray-chestnut mottling. Head dark gray (between deep mouse-gray and dark mouse-gray). Feet blackish gray. Tail black, sometimes with a light chestnut tinge. Roots of hair on tail dark gray (deep mouse-gray).

Back of dark-tailed Yenisei squirrels much paler, of purer gray (between mouse-gray and neutral-gray).

The chestnut- and red-tailed Altai and Yenisei specimens are very similar, hardly distinguishable in series.

Summer fur. We distinguish three principal types of summer fur. 1) most specimens are black. Color of back and flanks black or black-chestnut. Chestnut shade more prominent on head and sometimes also in middle part of back. White abdominal area small. 2) rust-chestnut specimens. Color of back between fuscous and natal-brown. Flanks grayer. Head usually grayer than back. Cheeks gray with light chestnut tinge (hair brown). Feet black-chestnut. 3) light rust colored specimens.
410 Back and flanks uniformly rust-brown (approaching mikado-brown). Muzzle, cheeks and chin markedly dirty gray (between hair-brown and mouse-gray). Feet dark chestnut. Tail generally reddish rust-chestnut with a marked black tinge. This red-tailed type is identical with the red-tailed Yenisei squirrel. According to B. A. Kuznetsov (1932) about 50% of the Altai squirrels are dark tailed, about 40% chestnut tailed and about 10% red tailed.

SYSTEMATIC NOTES. The Altai squirrel is closely related to the Yenisei squirrel, of which it is perhaps only a natio. It differs from it only as follows: 1) smaller size; 2) different percentage of color-types (see above); 3) darker color of dark types.

GEOGRAPHICAL DISTRIBUTION. Altai, Tarbagatai and Sayan mountains to the line connecting Krasnoyarsk with the northern spurs of the Kuznetsk Altai* in the north.

371. Sciurus vulgaris jacutensis Ogn. (1929). Yakut squirrel

1887. Sciurus vulgaris Bunge A., Berichte über die Expedition nach den Neusibir. Ins., S. 38.
1898. Sciurus vulgaris Iokhel'son V. I., Ocherk zveropromyshlennosti v Kolymskom okruge (A Survey of Commercial Hunting in the Kolyma District), Sankt Peterburg, pp. 60-68.
1900. "Belka" [squirrel], Slyunin N. V., Okhotsko-Kamchatskii krai (The Okhotsk-Kamchatka Territory), I, p. 326.
1903. Sciurus vulgaris calotus Allen I. A., Report on the Mammals collected in Northeastern Siberia, Bulletin of the American Museum of Natural History, Vol. XIX, pp. 134-136.
1911. Sciurus borealis Brass E., Aus dem Reiche der Pelze, S. 583 (Lena; Nomen nudum!).
1926. Sciurus vulgaris calotus Ognev, S. I., Mlekopitayushchie severo-vostochnoi Sibiri (Mammals of Northeastern Siberia), pp. 77-84.
1927. Sciurus vulgaris calotus Gassovskii G. N., Gilyui-Oldoiskii okhotnich'e-khozyaistvennyi raion (The Gilyui-Oldoi Hunting District), Vladivostok, pp. 523-526.
1928. Sciurus vulgaris fuscorubens (partim!) Serebrennikov M. (ex Dwigubski, 1804), Synopsis of Russian Squirrels, Doklady Akademii Nauk SSSR, p. 423.

TYPE LOCALITY AND DEPOSITION. Village Mugan, 8 km from Yakutsk. Type No. M. 2209 in S. I. Ognev's collection.

MATERIAL EXAMINED: holotype and 24 paratypes.

DIAGNOSIS. The two following color types predominate among winter specimens: 1) black-tailed — dark-colored specimens. Back blackish gray, without mottling or brownish tinge. 2) chestnut-tailed. Back blackish gray with an ash tinge. Percentage of red-tailed specimens small, between 1 to 20% according to locality. Color of back of red-tailed specimens in winter varying from light ash-mouse-gray to darker mouse-gray with well marked gray mottling. Summer color variable, between black (most common) and black-chestnut and even light chestnut. Winter fur fluffy and luxuriant. White area of belly small.

MEASUREMENTS average. Length of skull 50-52 mm (M. 51.6 mm); condylobasal length 45-49.3 mm (M. 47.2 mm); zygomatic width 29.2-32.2 mm (M. 31.1 mm); length of upper tooth row 9.1-10.2 mm (M. 9.8 mm).

411 DESCRIPTION. Dark-tailed and black-tailed specimens predominate in winter.

1) Black-tailed specimens: Middle of back dark grayish black with a dark chestnut tinge (between deep mouse-gray and dark quaker-drab). Flanks more ash colored (deep neutral-gray). Color uniform as there is no dark mottling. Head dark ash-gray, similar to that of back. Chin and lower parts of cheeks blackish gray (deep neutral-gray to deep purplish gray). White area of belly very small as the dark color of the flanks reaches far down. Groin blackish gray. White color of underparts forms a short wedge anteriorly which reaches to the middle of the neck. Feet blackish gray (dusky purplish gray). Soles with a gray-chestnut tinge (hair-brown). Tail black (between soot-black and dusky purplish gray). Roots of long hair on tail bluish-gray (dark mouse-gray).

2) Chestnut-tailed specimens are usually dark colored. Their color is similar to that of black-tailed specimens. The back has a more marked ash shade (neutral-gray). Dorsal side of tail of such dark chestnut-tailed specimens almost black. The ash-gray roots are more marked than in

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* [Obviously a mistake in the Russian original, should be Kuznetsk Ala-Tau.]

black-tailed specimens. Hair of ventral side of tail with two gray-buff bands or one rust-chestnut-gray ring before the broad black hair tip. The color of the hair on the tail is complex, i.e., roots deep ash-gray, followed by a narrow blackish gray band, a little marked blackish band, a rust-buff-gray subapical band and broad black hair tip. In lighter chestnut-tailed specimens the dorsal side of the tail is generally also black. A broad stripe formed by gray hair tips in the middle of the ventral side of the tail. The gray-rust-buff subapical bands of the hair are little marked, much less than in West Siberian and European chestnut-tailed specimens. Tail of Yakut chestnut-tailed specimens even darker than in western dark-tailed specimens.

Bald spine present in dark chestnut-tailed specimens and also in black-tailed ones.

3) Winter fur of red-tailed specimens. Color of back varying from light gray (light mouse-gray) to mouse-gray and light neutral-gray with gray mottling. Ears rust-chestnut (between mikado-brown and tawny). Tip of ears in many specimens darker, ash-chestnut with a light reddish tinge (fuscous with brown tinge).

Color of summer fur variable. There are specimens with a black back and a black or blackish gray tail and specimens with generally dark chestnut color (between bone-brown and warm sepia), with a brownish tinge
412 in the middle of the back. Ears and feet black-chestnut. Rust-buff-colored hair on feet. Color of tail similar to that of back. Color of hairs on tail as follows: roots dark mouse-gray (deep mouse-gray), followed by broad dark chestnut bands (warm sepia) with a light rust tinge. Hair tips black-chestnut. Hair roots on ventral side of tail light ash-gray (mouse-gray, sometimes light mouse-gray), alternating with short dark chestnut bands, followed by a rust-chestnut band, a dark chestnut band, a broader rust-colored band and chestnut-black apices.

In the lightest chestnut-tailed specimens, summer fur on back sometimes rich, rust colored. Tail similar.

SYSTEMATIC NOTES. In his survey of Russian squirrels, M.K. Serebrennikov (1928) suggests that the Okhotsk Coast, the Anadyr Territory, and the lower reaches of the Amur up to the Stanovoi Range in the east are inhabited by S. v. fuscorubens Dwigubski. In "Prodromus Faunae Rossicae" (1804) p. 83, Dwigubski describes fuscorubens as follows: "Hieme argenteo-griseus, duplo major communi". This description is obviously wrong. Dwigubski gives the distribution of the species as "In Siberia orientali" (p. 86). This information is certainly not reliable, and fuscorubens should be considered synonymous with the three East Siberian subspecies: jacutensis, anadyrensis and rupestris.

In old publications Siberian squirrels (especially the Yakutian squirrel) were sometimes called S. v. calotus. This name was, according to some authors, given by B.H. Hodgson (On a New Species of Mustela? known to the Nepalese commerce as the Chuakhal Mustela? Calotus nob., Calcutta, Journal of Natural History, II, 1842, pp. 221-223). Other authors think this name was given by J. Gray ("Synopsis of the Asiatic Squirrels", Annals and Magazine of Natural History, Vol. XX, series 3, 1867, p. 272).

In his article on "Mustela calotus" Hodgson wrote that "Nepali merchants" imported gowns trimmed with the fur of a beautiful animal named "Chuakhal", from an unknown locality in the north.

Hodgson obtained a skin of this animal without skull. He could not determine to which order the animal belonged. However, it resembled a squirrel and in Hodgson's opinion was a species of Mustela. The description of this skin resembles that of the dark Siberian squirrel. On the basis of the merchants' reports, Hodgson assumed that this mysterious animal was distributed in the Himalayas and Tibet.

At my request V.P. Uvarov examined the holotype of Mustela calotus in the collection of the British Museum. The label of the specimen bears the name "Nepal", which was subsequently emended to "Thibet" by O. Thomas. According to Uvarov it is without doubt a squirrel. Hodgson's article contains a plate of a very strange animal with the muzzle of a marten and the tail and ears of a squirrel.

413 As Sciurus vulgaris does not occur in the Himalayas, Tibet and Nepal, Mustela (?) calotus Hodgson is obviously a dark specimen of S. vulgaris without any definite type locality. The Nepali merchants apparently obtained skins of dark Siberian squirrels. Hodgson's description was apparently based on one of these skins.

I was surprised that O. Thomas ("Proceedings of the Zoological Society of London", 1905, p. 346) considered the mountains of Central Asia (including the Altai) as the terra typica of S. v. calotus, and that Sowerby accepted this.

The name Mustela (?) calotus cannot be used for the Siberian squirrel for the following reasons: 1) the description is vague; 2) the squirrel is placed in the genus Mustela with a question mark; 3) the range given is not correct.

But as there is a type specimen of a Siberian squirrel in the British Museum called Mustela (?) calotus, and as Gray refers to Hodgson's work in his description of S. calotus, it is correct to name the Siberian squirrel S. vulgaris calotus Gray (1867) ex Hodgson (1842).

The terra typica of this subspecies is given by J. Gray (1867, p. 212) as follows: "Hab. North. China, Thibet (Mr. Hodgson's type), Siberia."

This form does not occur in Tibet, and "Siberia" is too general. The type locality of Gray's S. v. calotus is therefore northern China which he mentions first. This interpretation makes it necessary to consider S. v. chiliensis Sowerby (1921) described from the Chihli* Province (75 miles northwest of Peking) as a synonym of S. v. calotus Gray.

The Yakut squirrel differs from the Yenisei squirrel as follows: 1) more luxuriant and silky fur; 2) darker color of back in winter fur. It differs from the Transbaikal subspecies (see below) as follows: 1) smaller size; 2) more luxuriant and silky fur. It differs from S. v. rupestris (see below) as follows: 1) more luxuriant fur; 2) smaller size.

The Anadyr squirrel is closely related to the Yakut squirrel, perhaps forming a natio of this. The differences between these two forms are given below.

B.A. Kuznetsov (in litt., 1935) examined 94,920 pelts of S. v. jacutensis and gives the following data on color types of the tail; 16% black-tailed; 34% dark-tailed; 32% dark chestnut-tailed; 18% red-tailed.

In my collection are color variants of squirrels from the Aldan river and from the upper reaches of the Indigirka. The labels of these specimens bear remarks based on information from local fur-trading companies by K.E. Vorob'eva (who placed this material at my disposal).

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* [Now Hopei Province.]

According to this information there are fewer red-tailed specimens then
414 given by B. A. Kuznetsov.

The figures given by K. E. Vorob'eva are as follows:

Anadyr squirrels	
Black-tailed	49 %
Dark-tailed	34 %
Chestnut-tailed (dark specimens)	7 %
Chestnut-tailed (light specimens)	3 %
Red-tailed	6 %

Squirrels from the upper reaches of the Indigirka	
Black-tailed	40 %
Dark-tailed	39 %
Chestnut-tailed	19 %
Red-tailed (dark specimens with bald spine)	0.1 — 0.2 %
Red-tailed	1 %

According to B. A. Kuznetsov (1932) the Lena squirrels differ from the Yakut squirrels. The Lena squirrels occur in the Vilyui and Vitim districts of Yakutia, and in the Kirensk, Irkutsk, and Tulun districts of the Siberian Territory. According to Kuznetsov, there are many different color types: black-tailed, dark-tailed, chestnut-tailed and red-tailed specimens. Series generally contain: about 11 % black-tailed specimens, 23 % dark-tailed, 49 % chestnut-tailed and 17 % red-tailed ones. These data are based on 212,458 skins. The color of the black-tailed specimens is similar to that of the Yakut squirrels, but the fur of the Lena strain is not so bluish and dark. Color of tail lighter and more drab.

Color of dark-tailed specimens lighter than that of black-tailed ones and color of spine lighter. Color of chestnut-tailed specimens still lighter.

Red-tailed specimens of the Lena strain differ from Yakut specimens in the weak rust tones on the spine. Tail and tufts on ears rich rust colored.

In order to determine whether there is a separate Lena race (or more correctly a natio) specimens from the Vilyui-Vitim districts on the left bank of the Lena should be compared with specimens from the right bank of the Lena.

GEOGRAPHICAL DISTRIBUTION. It is difficult to determine the boundaries of the range of this subspecies for lack of material. It apparently occurs in the upper reaches of the Lena, along the Vilyui, Muna. This is correct if we consider the Lena squirrel as identical with the Yakut subspecies. It also occurs along the Olenek. According to R. Maak (1886) it is very rare in this region, near 68° N. It occurs along the Aldan, Khanym, Indigirka, Yana (A. Bunge, 1887), Kolyma and Omolon rivers. This subspecies apparently also includes squirrels from Penzhin-Kamchatka. The southern slopes of the Stanovoi Range and the Dzhugdzhur Range are inhabited by the Okhotsk-Sakhalin subspecies. It is not clear which subspecies occurs in the Gilyui-Ol'doi hunting territory. According to G. N. Gassovskii (1927), squirrels are very common in pine forests in this region and it is possibly inhabited by a subspecies either closely related to or identical with the Yakut subspecies, or perhaps transitional to the Okhotsk-Sakhalin subspecies.

415 371. Sciurus vulgaris jacutensis natio anadyrensis Ognev (1929). Anadyr squirrel

1883. Sciurus vulgaris Nordquist O., Anteckingar och. studier till Sibirska ishafskustens Däggdjursfauna, p. 80.

1927. Sciurus vulgaris calotus Sokol'nikov N. P., Okhotnich'i i promyslovye zveri Anadyrskogo kraya (Game and Commercial Animals of the Anadyr Territory), Byulleten' Moskovskogo obshchestva ispytatelei prirody, XXXVI, pp. 134-136.

1929. S(ciurus) v(ulgaris) jacutensis natio anadyrensis Ognev S. I., Über einige Nagetiere Ost-Sibiriens. Zoologisch. Anzeiger, Bd. 83, H. 1/4, S. 83.

1935. Sciurus vulgaris anadyrensis Ognev S. I., Sistematicheskii obzor belok, vodyashchikhsya v SSSR (A Systematic Survey of the Squirrels of the U. S. S. R.), Byulleten' Nauchno-issledovatel'skogo insitituta zoologii Moskovskogo universiteta, Vol. II, p. 48.

TYPE LOCALITY AND DEPOSITION. No. 4449, Anadyr Territory, N. P. Sokol'nikov. Holotype in the Zoological Museum of Moscow University.

MATERIAL EXAMINED: holotype and 23 paratypes.

DIAGNOSIS. Closely related to the Yakut squirrel. Winter fur differing from that of the Yakut squirrel as follows: 1) more marked dull chestnut tinge on back, often forming well marked bald spine; 2) more marked chestnut or chestnut-gray mottling which is almost absent in Yakut squirrels; 3) more luxuriant fur.

MEASUREMENTS. Length of skull 50.3-54 mm (M. 52.4 mm); condylobasal length 45.6-48.5 mm (M. 47.2 mm); zygomatic width 30.2-31.8 mm (M. 31.1 mm); length of upper tooth row 8.8-10.1 mm (M. 9.2 mm); hind feet 50-62 mm (M. 57.1 mm); tail 145-180 mm (M. 162.8 mm).

ADDITIONAL DESCRIPTION. Color of winter fur closely resembling that of S. v. jacutensis. Unfortunately, I had only one summer pelt of the Anadyr squirrel at my disposal. Back dark-chestnut. A narrow red-ocher stripe (ochraceous tawny-tawny) on flanks, at the limit between the dark dorsal area and the white belly. Tail of the dark* type.

In the Zoological Museum of the Moscow University are red-tailed squirrels caught by N. P. Sokol'nikov in the Anadyr Territory. He apparently collected rare color types. N. P. Sokol'nikov (1927) calls the red-tailed squirrels in winter fur "color variants" and writes that he has several such specimens.

Color of back of red-tailed squirrels of the Anadyr Territory in winter dirty buff-gray (light drab) with a buff-rust tinge (wood-brown, sometimes with a rust tinge). Bald-spine specimens occur. Back generally with chestnut-gray mottling.

In the ZMMU** is a collection of aberrant specimens of S. v. jacutensis natio anadyrensis. Two of them are true albinos, and three are flavescent, pale buff-yellow with buff-gray-chestnut tails.

416 SYSTEMATIC NOTES. Closely related to the Yakut squirrel, but the color of this is purer and more bluish than that of the Anadyr squirrel and without chestnut shades. Bald-spine is rare among Yakut squirrels.

GEOGRAPHICAL DISTRIBUTION. Larch forests of the Anadyr Territory (called in Russian "listvyaga"). One of these forests begins 50-60 km above the village Markovo and stretches for 170 km along the Anadyr river. Another forest follows the Maina river, at its left tributaries (the Algans). This forest is much smaller than the former. These forests are narrow, not wider than 1-3 km. N. P. Sokol'nikov (1927) writes: "The forests of the Anadyr area are separated from the Siberian forest belt. This squirrel is therefore isolated and localized. It cannot go anywhere and its population cannot increase by immigration of squirrels from other areas."

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* N. P. Sokol'nikov (1927) describes the Anadyr squirrel as follows: "In summer the squirrel is reddish, resembling the European squirrel but darker..."

** [ZMMU — Zoological Museum of the Moscow University.]

372. Sciurus vulgaris fusconigricans Dwigubski (1804). Transbaikal squirrel

1804. S(ciurus) vulgaris fusconigricans Dwigubski J., Prodromus Faunae Rossicae, pp. 83-84.

1862. Sciurus vulgaris Radde G., Reisen im Süden von Ost-Sibirien. S. 133-146.

1910. Sciurus vulgaris Kashchenko N. F., O kollektsii mlekopitayushchikh Zabaikal'ya (A Collection of Mammals from Transbaikalia), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XV, pp. 273-274.

1922. Sciurus vulgaris varius Dybovski Ben., Arch. Tow. Naukow, Lwowie, III, p. 8.

1928. Sciurus vulgaris fusconigricans Serebrennikov M., Synopsis of Russian Squirrels, Doklady Akademii Nauk, p. 423.

1929. Sciurus vulgaris Kuznetsov B. A., Zverovye promysly vostochnogo Zabaikal'ya (Animal Commerce in Eastern Transbaikalia), Trudy po lesnomy opytnomu delu, Tsentral'naya lesnaya opytnaya stantsiya, Issue VI, pp. 87-89.

1935. Sciurus vulgaris fusconigricans Ognev S. I., Sistematicheskii obzor belok, vodyashchikhsya v SSSR (A Systematic Survey of the Squirrels of the U. S. S. R.), Byulleten' Nauchno-issledovatel'skogo instituta zoologii Moskovskogo universiteta, Vol. II, p. 48.

TYPE LOCALITY. Barguzin, Transbaikalia ("ad Bargusin" according to Dwigubski). Holotype lost.
MATERIAL EXAMINED: 16 specimens.

DIAGNOSIS. Back in winter specimens dark bluish gray with fine, well marked gray-black mottling in black-tailed and dark-tailed specimens. Color of chestnut-tailed specimens lighter and grayer. Specimens with black or black-chestnut back predominate among summer specimens. Dark chestnut specimens are common. Dark brownish chestnut specimens (red-tailed ones) are apparently much less frequent. Winter fur not as luxuriant and fluffy as in the Yakut squirrel. White abdominal area small.

MEASUREMENTS large. Length of skull 52-55.8 mm (M. 54.5 mm); condylobasal length 48-52 mm (M. 50.4 mm); zygomatic width 31-33.2 mm (M. 32.9 mm); length of upper tooth row 9.2-10.2 mm (M. 9.6 mm); hind feet 51-60 mm (M. 54 mm); tail 160-185 mm (M. 175 mm).

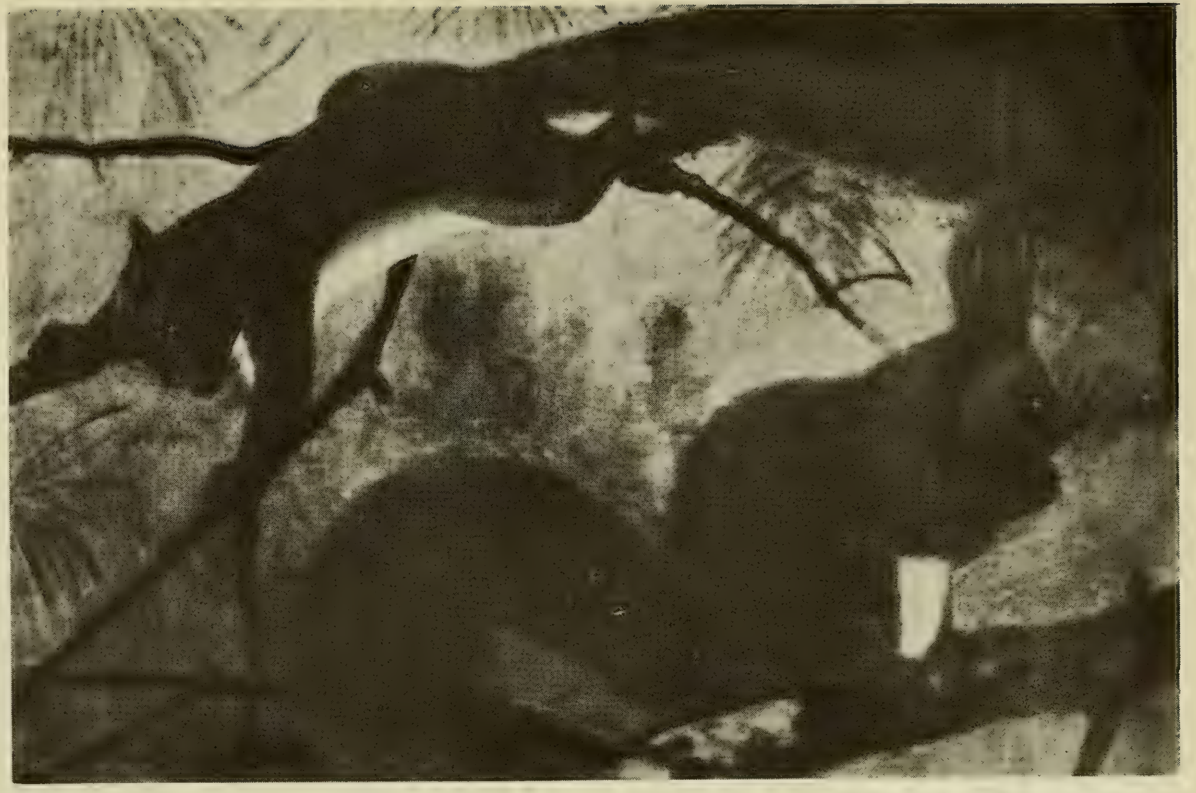
DESCRIPTION. Winter fur usually very dark, deep gray (between deep neutral-gray and deep mouse-gray) with fine well marked grayish black mottling. This distinguishes the subspecies from dark S. v. jacutensis which has no such mottling. Top and sides of head dark gray with well marked mottling. Ears black. Feet blackish gray. Tail of the black or dark type. Chestnut-tailed specimens of the dark type are rare.

417 In chestnut-tailed specimens of the dark type the back is much lighter than in dark- or black-tailed specimens. Back dirty chestnut-gray, nearly mouse-gray. White abdominal area markedly reduced.

The color of summer fur shows three types. To the first type belong squirrels of black or black-chestnut color and with black or dark tails. The second type has the following characters: back deep dark chestnut (between bone-brown, natal-brown and fuscous); flanks grayer; ears and tail black-chestnut; tail of the dark-chestnut type.

The third type is rare and consists of red-tailed squirrels. Back dark chestnut-brown (between walnut-brown, russet). Flanks grayer (natal-brown). Anterior part of head and cheeks with well marked grayish

PLATE VIII



The Manchurian squirrel (Sciurus vulgaris mantchuricus Thos.). Upper figure — summer fur of the tricolor type; lower figure — winter fur

Drawing by V. A. Vatagin

chestnut tones. Tail brown-chestnut with mouse-gray hair roots. Feet chestnut-brown.

According to B. A. Kuznetsov (in litt. 1935), Transbaikalian squirrels usually include about 38% black-tailed specimens, 26% dark-tailed, 33% dark chestnut-tailed, and only about 3% red-tailed specimens. These data are based on 51,108 skins.

SYSTEMATIC NOTES. S. v. fusconigricans differs from S. v. jacutensis as follows: 1) larger size; 2) less luxuriant winter fur; 3) dark mottling on back of dark-tailed and black-tailed winter specimens. It differs from the Manchurian squirrel (see below) as follows: 1) smaller size; 2) more intense color of back in winter specimens; 3) presence of red-tailed specimens.

GEOGRAPHICAL DISTRIBUTION. Widely distributed in Transbaikalia, along the Barguzin, Upper Angara, Vitim, Olekma, and Shilka rivers, on the Muiskii Range, and in the Chita and Verkhneudinsk* districts. According to B. A. Kuznetsov (1929), it is not found in isolated pine forests along the Onon river. It occurs in larch forests on the Yablonovyi Range. M. K. Serebrennikov (1928) records this subspecies from forests near Lake Khubsugul and from Northern Mongolia. To judge from my material, this region is inhabited by a form more closely related to the Altai squirrel, or transitional between the Altai and Transbaikalian squirrels. Such transitional specimens occur on the northwestern spurs of the Khingan. They are intermediate between S. v. fusconigricans and the larger Manchurian squirrel.

373. Sciurus vulgaris mantchuricus Thos. (1909). Manchurian squirrel

1858. Sciurus vulgaris Schrenck L., Reisen und Forschungen im Amur-Lande, I, S. 118-124 (partim!).

1859. Sciurus vulgaris Maak R., Puteshestvie na Amur, Obzor zhivotnykh (An Expedition to the Amur. A Zoological Survey), Sankt Peterburg, p. 103 (partim!).

1870. Sciurus vulgaris Przheval'skii N. M., Puteshestvie v Ussuriiskom krae (A Journey to the Ussuri Territory), Sankt Peterburg, pp. 255-256.

418 1909. Sciurus vulgaris mantchuricus Thomas O., Annals and Magazine of Natural History, ser. 8, Vol. IV, p. 501.

1912. Sciurus vulgaris mantchuricus Ognev S. I., O kollektsii mlekopitayushchikh iz Ussuriiskogo kraya (A Collection of Mammals from the Ussuri Territory), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, Vol. XVI, pp. 500-502.

1923. Sciurus vulgaris mantchuricus Sowerby A. de C., The Naturalist in Manchuria, Vol. II-III, p. 146.

1928. Sciurus vulgaris mantchuricus Serebrennikov M., Synopsis of Russian Squirrels, Doklady Akademii Nauk, p. 423.

1935. Sciurus vulgaris mantchuricus Ognev S. I., Sistematicheskii obzor belok. vodyashchikhsya v SSSR (A Systematic Survey of the Squirrels of the U. S. S. R.), Byulleten' Nauchno-issledovatel'skogo instituta zoologii Moskovskogo universitata, Vol. II, p. 49.

TYPE LOCALITY AND DEPOSITION. Great Khingan. Holotype in the British Museum.

MATERIAL EXAMINED: 30 specimens.

DIAGNOSIS. Back in winter specimens (Plate VIII) intense gray with fine, well marked dark mottling. Color generally lighter than in Transbaikal squirrels. There are sometimes bald-spine winter specimens with a light chestnut tinge on the lower part of the back. Most specimens are black- or dark-tailed. Dark chestnut-tailed specimens are rare. Red-tailed specimens do not occur*. The summer specimens show four color types. Most common are specimens with black or black-chestnut back. The other two are tricolored squirrels which occur more rarely: 1) squirrels with dull brown-gray back and rust-red lateral stripe; 2) specimens with saturated chestnut-brown back and narrow, gray lateral stripes. Rust-brown-ocher squirrels are very rare. Most summer specimens are black-tailed. Lighter specimens include dark-tailed and rarely dark-chestnut-tailed specimens. Fur of winter specimens shorter and less luxuriant than in Transbaikal specimens.

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* [Now Ulan-Ude.]

MEASUREMENTS large. Length of skull 53-57 mm (M. 55 mm); condylobasal length 48.3-51.3 mm (M. 50 mm); zygomatic width 30-33.7 mm (M. 32 mm); length of upper tooth row 9-10.1 mm (M. 9.8 mm).

DESCRIPTION. Winter fur. Back gray (between neutral-gray and mouse-gray), generally lighter than in S. v. fusconigricans. Back with well marked dark gray mottling. Ears and feet dark gray. Tail of the black or dark type. Dark chestnut-tailed specimens are rare. Bald-spine specimens are also rare. They have a light chestnut tinge caused by chestnut-white hair tips and light chestnut bands before the black subapical bands of the hair on the lower part of the back.

Summer fur shows four types. To the first type belong squirrels with black or black-chestnut back. This color varies between deep chestnut-black and brilliant black. Drab tones are occasionally present on cheeks and around the eyes. Flanks of the same color as the back. Ears and feet black. Tail of the black type, rarely of the dark type.

The second color type consists of tricolored squirrels (Plate VIII, upper figure). Dorsum dull brown-gray (between natal-brown and warm-sepia). 419 Area around eyes, sides of muzzle and cheeks buff-drab (hair-brown) with fine chestnut-gray mottling. A rich ocher-red-rust stripe (orange-cinnamon) on the flanks between the brownish gray back and the white belly, from the neck to the inner sides of the legs. Outer sides of legs, shoulders, antebrachia, haunches and tibiae of the same color as the back. Inner sides of legs ocher-red-rust. Feet brownish gray-chestnut. Dorsal side of toes chestnut colored. Tail of the dark type, black in some specimens and rarely of the dark chestnut type.

The third type also includes tricolored squirrels. Head, back, outer sides of legs and feet chestnut-brown (argus-brown with chestnut tinge). Dirty gray (mouse-gray) with chestnut mottling predominates on the sides of the muzzle, cheeks and around the eyes. A narrow gray stripe (deep mouse-gray) on the flanks between the chestnut-brown back and the white underparts, from the sides of the neck to the inner sides of the legs. Tail of the dark type. Black color of root of tail sometimes with a well marked chestnut-brown shade.

The fourth type of summer fur includes squirrels with the following colors: Back rich rust-brown-ocher (between tawny and russet). Muzzle lighter and yellower. Region around the eyes grayer. Forehead of the same color as the back. Occiput with well marked chestnut-gray tones. A narrow yellow-rust stripe (cinnamon-buff) on the flanks between the rust-brown-ocher back and the white underparts from the sides of the neck to the inner sides of the legs. Feet rust-brown-ocher, closely resembling that of back. Tail of the dark type, rarely of the dark-chestnut type. This color type is rare in summer specimens. Black or black-chestnut summer specimens predominate, constituting 80% of the population. Tricolored specimens are less frequent, and light specimens are very rare.

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* Or are very rare. I never saw such specimens.

SYSTEMATIC NOTES. The differences between S. v. mantchuricus and S. v. fusconigricans have been given above. The Manchurian squirrel differs from S. v. rupestris as follows: 1) larger size; 2) smaller percentage of bald-spine winter specimens; 3) complete absence of red-tailed specimens.

GEOGRAPHICAL DISTRIBUTION. Manchuria, northern part of the Kirin Province (de Sowerby, 1923), on the Great Khingan (O. Thomas, 1909), in the Ussuri and the Maritime territories, to about 48-49°N. Squirrels from the Lesser Khingan and Northern Korea apparently belong to this subspecies.

374. Sciurus vulgaris rupestris Thos. (1907). Sakhalin-Amur squirrel

1861. Sciurus vulgaris Schmidt Fr., Bemerk. über die Säugethiere Süd Sachalins etc., Mélange Biologique de l'Académie Impériale de Saint-Pétersburg, Vol. IV, p. 107.

1889. Sciurus vulgaris Nikol'skii A. M., Ostrov Sakhalin i ego fauna pozvonochnykh zhivotnykh (The Vertebrate Fauna of Sakhalin Island), pp. 123-125.

420 1907. Sciurus vulgaris rupestris Thomas O., The Duke of Bedford's Zoological Explorations in Eastern Asia, IV, Proceedings of the Zoological Society of London, Vol. I, p. 410.

1923. Sciurus vulgaris rupestris Sowerby A. de C., The Naturalist in Manchuria, Vols. II-III, p. 147.

1928. Sciurus vulgaris rupestris Serebrennikov M., Synopsis of Russian Squirrels, Doklady Akademii Nauk SSSR, p. 424; Ognev S. I., Mlekopitayushchie Shantarskikh ostrovov (Mammals of the Shantar Islands), Izvestiya Tikhookeanskoi nauchno-promyslovoi stantsii, II(5): 15 et seq., 1929.

1929. Sciurus vulgaris dulkeiti Ognev S. I., Über einige Nagetiere Ostsibiriens, Zoologischer Anzeiger, Bd. 83, H. 1/4, S. 76-85.

TYPE LOCALITY AND DEPOSITION. The Korsakov Station on Sakhalin Island. Holotype in the British Museum.

MATERIAL EXAMINED: 100 pelts, most of them with skulls.

DIAGNOSIS. Color very similar to that of S. v. mantchuricus. Winter fur more luxuriant and percentage of bald-spine specimens higher. Black or black-chestnut specimens predominate among summer specimens. Black- and dark-tailed specimens are most common. Dark-chestnut specimens are rare. Red-tailed specimens extremely rare.*

MEASUREMENTS smaller than those of S. v. mantchuricus. Length of skull (Figure 187) 50.6-55.3 mm (M. 52.6 mm); condylobasal length 46.1-50.3 mm (M. 47.9 mm); zygomatic width 28.3-32.5 mm (M. 30.8 mm); length of upper tooth row 9-10.2 mm (M. 9.7 mm); hind feet 56-67 mm (M. 59.8 mm); tail 165-206 mm (M. 184 mm).

ADDITIONAL DESCRIPTION. Color of winter fur closely resembling that of the Manchurian squirrel, generally more luxuriant. Bald-spine specimens are apparently more frequent.

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* B. A. Kuznetsov (in litt. 1935) gives the following figures with regard to tail color in the Amur strain: 25% black-tailed, 34% dark-tailed, 35% dark-chestnut-tailed and 6% red-tailed. These data are based on 53,287 skins. The Amur strain includes squirrels from the Amur Region, the Ussuri Territory, Sakhalin and the Shantar Islands. According to B. A. Kuznetsov, red-tailed specimens of the Amur strain occur only in the middle reaches of the Amur.

Black and chestnut-black specimens apparently predominate in summer. Percentage of black- and dark-tailed specimens very high. Chestnut-colored specimens occur together with black summer specimens. Back of chestnut-colored specimens deep chestnut-brown (warm-sepia) with a black tinge and chestnut-black mottling. Roots of guard hairs and hair of undercoat gray (neutral-gray). Hair tips of undercoat dull rust colored. Gray roots of guard hair followed by a black or chestnut-black band, a rust-brown band (near mikado-brown) and black or black-chestnut hair tips. There are also longer hairs with gray roots and black tips. Brown-rust tone more marked on the head than on the back. Forehead, region around the eyes and cheeks with a marked gray tinge (near deep mouse-gray). Feet black or black-chestnut. A wide blackish gray stripe between the chestnut-brown-black back and the much reduced white abdominal area from the sides of the neck and along the flanks. This stripe causes the
421 tricolored fur, with chestnut-brown back, grayish black flanks and white underparts.

Tail of most summer specimens of the black or dark type. In my collection is a young specimen with a peculiar tail color (No. M. 3796, Sakhalin, Argi-Pagi, 13 July 1932, A Rekst). Tail dull yellowish drab-rust. Roots of guard hairs dull buff-gray and hair tips gray-rust. There are also hairs with broad black-chestnut tips. The combination of these colors creates the dull yellowish drab-rust color.

Red-tailed specimens are very rare, e.g., from the Goryun river (a tributary of the Amur), and a specimen from the Great Shantar Island. Back of these specimens rust-ocher-chestnut, similar to color of tail. Only one red-tailed specimen was found among 160 Amur squirrels (not counting the specimen from the Great Shantar Island).

SYSTEMATIC NOTES. In 1929 I described the subspecies S. v. dulkeiti from the Shantar Islands ("Zoologischer Anzeiger", loc. cit, 1929). On the basis of published data (O. Thomas, M.K. Serebrennikov) I thought that S. v. rupestris from Sakhalin Island is a small insular form which differs from the Middle Amur form. After examination of squirrels from Sakhalin I found that this was wrong. S. v. rupestris is not smaller than the Shantar and Middle Amur squirrels; it is identical with them.

S. v. rupestris is closely related to S. v. mantchuricus from which it differs in its smaller size.

GEOGRAPHICAL DISTRIBUTION. Sakhalin and Shantar islands and the Amur Territory, to about 48-49°N in the south. Farther south S. v. mantchuricus occurs. The exact boundary between these two closely related subspecies is not known. There may be no sharp boundary. South of 48-49 N the size of the squirrels becomes larger. Between Bira and Bidzhan rivers there occur specimens of S. v. mantchuricus with large skulls.

Subgenus **Tenes** Thos.

1778. Sciurus Gmelin J., Systema Naturae Linnaei, editio XIII, Vol. I, p. 148 (S. anomalus).

1811. Sciurus Pallas P. Zoographia Rosso-Asiatica, I, pp. 186-187 (S. caucasicus).

1909. Tenes Thomas O. The Generic Arrangement of the African Squirrels, Annals and Magazine of Natural History, III(8): 468 (S. persicus; footnote).

1935. Oreosciurus Ognev S.I., Sistematichekii obzor belok, vodyashchikhsya v SSSR (A Systematic Survey of the Squirrels of the U.S.S.R.), Byulleten' Nauchno-issledovatel'skogo instituta zoologii Moskovskogo universiteta, No. 2, pp. 50-51.

Species of this subgenus differ from true Sciurus in the following
422 characters: 1) color not varying with the seasons; 2) belly not white like in true squirrels but rust-chestnut of various shades, or buff-yellow; 3) hind soles with six calluses (S. vulgaris has only four); 4) teats 10 (S. vulgaris has 8); 5) one pair of upper premolars (S. vulgaris has two pairs); 6) Structure of crowns of premolars differs from that of S. vulgaris (see below); 7) shape of os penis differs from that of true squirrels (see Figure 196).

Type species: Sciurus persicus Erxl.

GEOGRAPHICAL DISTRIBUTION. Transcaucasia, Asia Minor, Syria, Palestine and part of Iran.

165. Sciurus (Tenes) persicus anomalus Gmel.(1778). Caucasian squirrel

1778. Sciurus anomalus Gmelin J., Systema Naturae Linnaei, editio XIII, Vol. I, p. 148.

1811. Sciurus caucasicus Pallas P., Zoographia Rosso-Asiatica, I, pp. 186-187 ("frequens est in fagetis et quercetis subalpinis et montanis Caucasi... ").

1840. Sciurus caucasicus, Nordmann A., Observations sur la Faune Pontique; A. Demidoff, Voyage dans la Russie Méridionale, III, p. 55; Simashko Yu., Russkaya fauna (Russian Fauna), II, 1851, p. 593; Bogdanov M. N., Etyudy russkoi okhoty, Okhotnich'i i promyslovye zveri i ptitsy Evropeiskoi Rossii (Studies on Hunting in Russia. Game and Commercial Mammals and Birds in European Russia), Okhota i konnozavodstvo, Nos. 5-6, 1874, p. 121.

1843. Sciurus russatus Wagner J. A., Die Säugethiere von Schreber, Suppl. III, Erlangen, S. 155, 156 (without indication of locality; presumably the Asian part of Turkey. The description of the color corresponds to that of anomalus).

1884. Sciurus persicus (partim!) Lataste F., Sur Sciurus persicus, Le Naturaliste, pp. 1-4.

1920. Sciurus anomalus Satunin K. A., Mlekopitayushchie Kavkazskogo kraya (Mammals of Caucasia), Vol. II, pp. 49-64.

1928. Sciurus anomalus, Serebrennikov M., Synopsis of Russian Squirrels, Doklady Akademii Nauk, p. 425.

NAMES: The Caucasian or Georgian squirrel (English); das Transkaukasische Eichhörnchen (German); l'Écureuil de Caucase, l'Écureuil anomal (French).

LOCAL NAMES: tritina, tria (Georgian); tsikvi, tsiku (Kakhetia); abkhidkha (Abkhazian); kovkasi skyur (literary Armenian); mkrosh (vernacular Armenian); garmzy sychan (Kurds along river Tertera).

TYPE LOCALITY AND DEPOSITION. Transcaucasia (without exact indication of locality). Type lost(?).

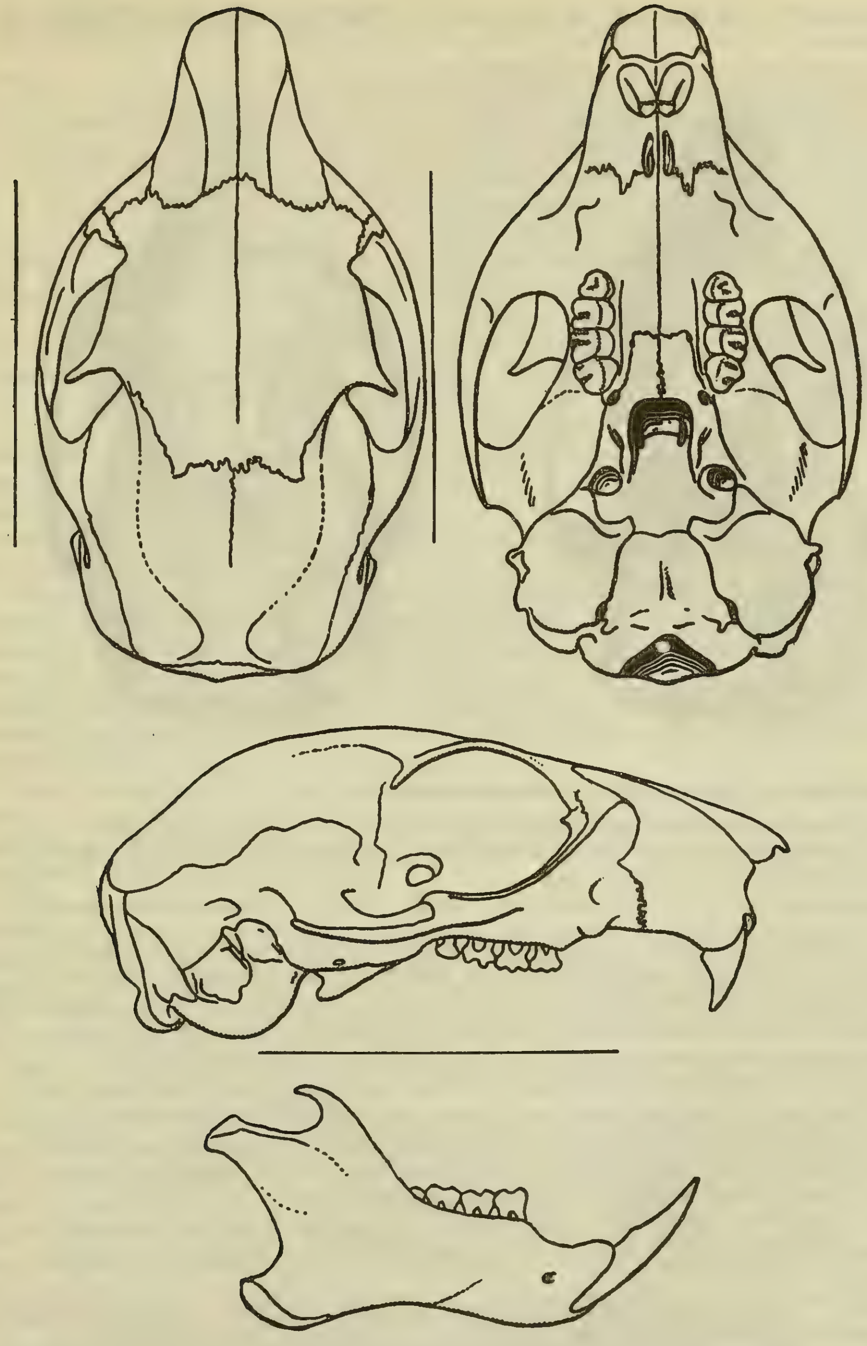
PRINCIPAL FIGURES: 1) Schreber J., Säugethiere, Erlangen, IV, 1792; 2) Simashko Yu., Russkaya fauna. II, Mlekopitayushchie (Russian Fauna. II. Mammals), 1851, pl. 32, fig. 1 (in color); 3) Vinogradov B. S., K poznaniyu gryzunov Zakavkaz'ya (The Rodents of Transcaucasia), Zapiski Kavkazskogo muzeya, A(3) (damaged nuts); 4) Satunin K. A., Mlekopitayushchie Kavkazskogo kraya (Mammals of Caucasia), Vol. II, 1920, p. 48, figs. 130-131 (skull ventral and dorsal); p. 51, fig. 132 (skull lateral); p. 53, fig. 133 (molars).

MATERIAL EXAMINED: 10 specimens.

DIAGNOSIS. Back chestnut-gray-buff with blackish chestnut mottling. Lower part of back of many specimens (especially in winter fur) black-chestnut. Flanks chestnut-brown. Underparts rust-yellow-brown. Tail chestnut-brown-rust. Terminal part of tail in some specimens with a black band before the ocher-yellow tip (plate IX).

424 Length of skull 50-53 mm; condylobasal length 46.3-49 mm; zygomatic width 28-31 mm; length of upper tooth row 9.5-10 mm; hind feet 52-56 mm; tail 130-159 mm.

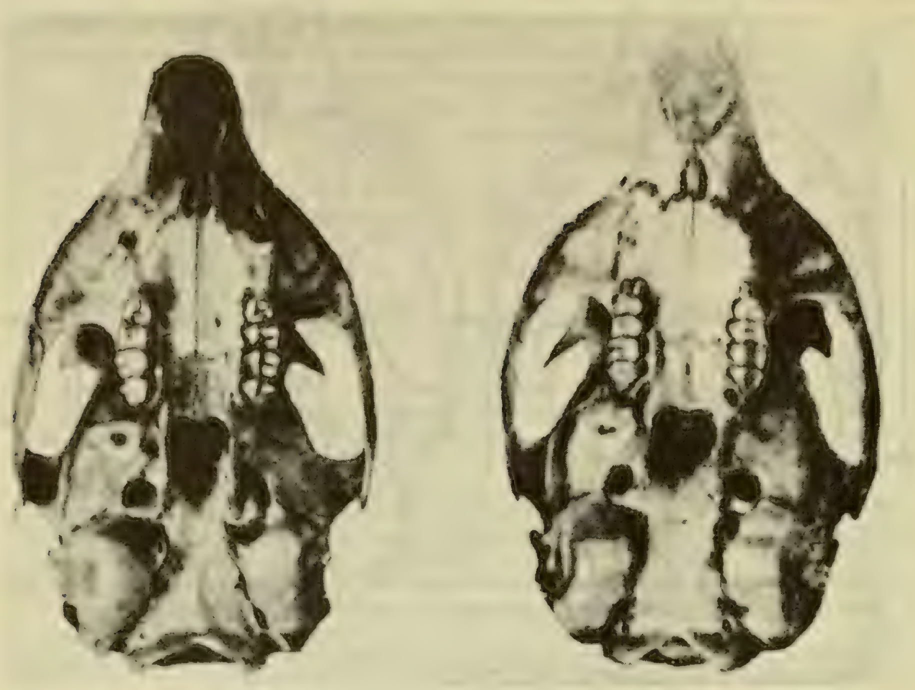
ADDITIONAL DESCRIPTION. The skull of the Caucasian squirrel differs from that of S. vulgaris as follows: 1) coronal suture with two pointed processes of the frontals; coronal suture of S. vulgaris rounded or nearly straight, sometimes with two rounded processes; 2) frontal suture longer



FIGURES 190-193. Skull of Caucasian squirrel, Sciurus (Tenes) persicus anomalus Gmel., No. M.2079, 24 Jan. 1927, village Dzhar of the Zakataly District. M. V. Shidlovskii, S. I. Ognev's collection

Drawing by Yu. A. Kostylev

424 than that of S. vulgaris; 3) zygomatic arches narrower (see Figures 189-195).



FIGURES 194, 195. Skull of the Caucasian and common squirrel

Left — skull of Sciurus (Tenes) persicus anomalus Gmel. (ventral), No. M. 12078, S. I. Ognev's collection. Right — skull of Sciurus vulgaris kessleri Migulin, No. M.3704, male, 25 Nov. 1927, former Kiev Province

Photograph by S. I. Ognev

S. persicus and S. vulgaris differ markedly in the structure of the teeth. The first upper premolar is absent in the Caucasian squirrel. The second upper premolar is larger and more rounded than in S. vulgaris in which it is bevelled off anteriorly to some extent. Inner tubercle of second upper premolar better developed and more rounded than in S. vulgaris. First lower premolar with two anterior tubercles which are higher and more rounded than the more widely-separated tubercles of
425 S. vulgaris. Incisors shorter and weaker than in the common squirrel.

Os penis. The baculum of the Caucasian squirrel is larger and more curved distally than that of S. vulgaris (see Figures 171-172 and Figure 196). Os penis of S. anomalus 11 mm long and its diameter at the base 2.6 mm; in S. vulgaris length 8.1-9 and width at the base 2.1-2.2 mm.

Color. In winter specimens color of back of two types: 1) back chestnut-gray-buff with blackish chestnut mottling; 2) anterior half of back of the same color and the lower part of back, from loin to base of tail brilliant black-chestnut with light whitish buff mottling. Color of hairs on back as follows: Hair roots deep gray (hair-brown) followed by a narrow black-chestnut band, a pale whitish buff band and chestnut-black hair tip. Some longer guard hairs with black-chestnut tips scattered throughout the fur.

In squirrels with black-chestnut lower part of back, hairs in this region are colored as follows: hair-roots deep gray (chaetura-drab), followed by a narrow black-chestnut band, a whitish band and black-chestnut tip. Forehead, upper parts of cheeks and occiput rust-chestnut with black-gray mottling (between sayal-brown and mikado-brown). Eyes surrounded by a light buff-white-gray ring. Flanks and shoulders chestnut-brown (between hazel and russet).

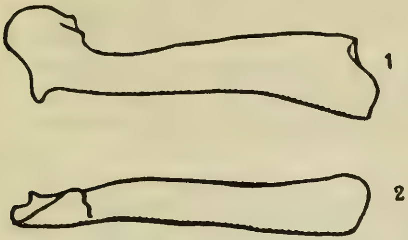


FIGURE 196. Os penis of the Caucasian squirrel

1 — lateral; 2 — dorsal (highly magnified). Drawing by Yu. A. Kostylev

Dorsal side of legs of the same color as the back. Outer side of hind legs rust-brown (sayal-brown with tawny tinge).

Soles buff-yellow-gray, between cinnamon-buff and avellaneous. Each hind sole with an irregular black spot along the inner margin. Ears of the same color as the soles, with small terminal tufts, 10-12 mm long.

Underparts from chin to groin saturated rust-yellow-brown (between cinnamon-buff and cinnamon).

Dorsal side of tail chestnut-brown-rust (between russet and mars-brown). Tip of tail ocher-yellow (ochraceous-tawny) with a black subapical band in some specimens. This dark band is caused by black 426 hair with ocher-yellow tips at the tip of the tail. Middle of ventral side of tail pale rust-yellow or yellowish drab. Ventral side laterally more intense rust-red. Hair of margins of ventral side of tail with black subapical bands and pale yellowish tips.

Color of summer fur little different from that of winter fur. Back in summer generally lighter, brown, and without the black tone of winter specimens. Underparts of summer specimens usually of more intense color with more marked rust tone.

Soles of forefeet with five well developed calluses. The two posterior caluses are more rounded and higher than the three anterior calluses at the base of the toes. One large, elongate callus at the outer margin. One rounded, small callus near the inner margin. Soles of forefeet almost bare Hind soles of winter specimens with sparse, short hair. Claws of forefeet shorter than in true squirrels (Figures 197, 198).

Teats 10: p. 1-1; a. 2-2; i. 2-2; total 10. In Sciurus vulgaris p. 1-1; a. 2-2; i. 1-1; total 8.

SYSTEMATIC NOTES I placed the Caucasian, the Persian and Syrian squirrels in one subgenus, Oreosciurus, in 1935. I had unfortunately overlooked a footnote in O. Thomas' paper on African squirrels (op. cit., 1909, p. 469): "S. persicus with only 4/4 cheek teeth, but similar to true Sciurus in all other characters, should form a special subgenus, which might be called Tenes." This quotation shows that Thomas took into account only the reduced number of upper premolars, ignoring a number of important characters which distinguish this peculiar group of squirrels. The name Tenes has to be adopted because of priority, in spite of the incomplete and superficial diagnosis given by Thomas.

During examination of a series of Caucasian squirrels I noticed that, in Abkhazian squirrels, the color of the flanks is a saturated red-rust (mikado-brown-orange-cinnamon, pl. XXIX), the belly intense ocher (cinnamon) and the groin shows yellowish spots (cinnamon-buff, pl. XXIX). Tail intense chestnut-red (russet, pl. X) with a rust tinge at the tip (mikado-brown-orange-cinnamon). Back with marked black tone and buff-yellow mottling.

The Abkhazian squirrels are possibly a western race of the Caucasian squirrel with more saturated color, but this is unlikely as there are squirrels in Artvin which differ very little from squirrels in Central Transcaucasia.

The Persian squirrel, Sciurus (Tenes) persicus Erxl., is closely related to anomalus. I examined seven specimens from the vicinity of Balkh near the Irano-Turkish border (collected by Nesterov) and one specimen from Iran (collected by N. A. Zarudnyi) in the ZMAN The summer fur of the Persian squirrel is light, gray-buff-rust, grayer
427 and lighter than pinkish buff (pl. XXIX Ridgway, 1912). Top of head more ocher, (near pinkish cinnamon, pl. XXIX). Cheeks, throat, chin, flanks, belly and feet buff-yellow with a light rust tinge (pinkish buff, pl. XXIX).

Tail dorsally ocher-rust (cinnamon-buff) with yellowish hair tips (cinnamon-buff). Median ventral line of tail pale yellowish rust (pinkish buff). Sides of ventral area of tail more rust colored (cinnamon-buff).

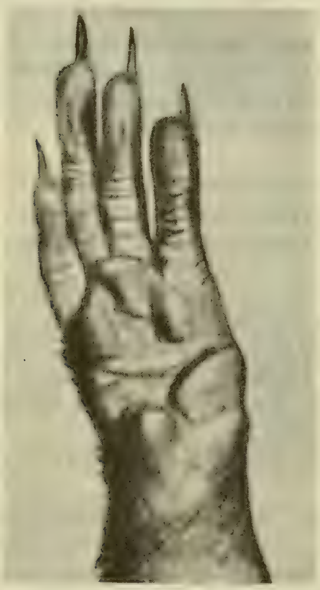


FIGURE 197. Ventral side of forefoot of Sciurus (Tenes) persicus anomalus Gmel., No. S.1352, Murav Dagh

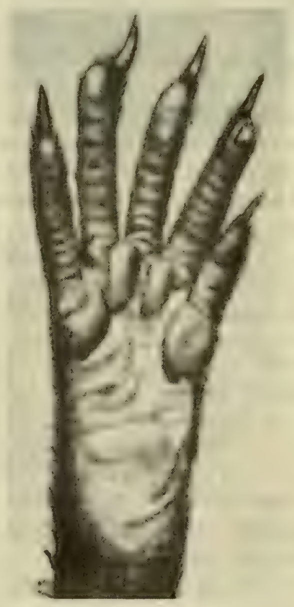


FIGURE 198. Hind foot of Sciurus (Tenes) persicus anomalus Gmel.
Photograph by S. I. Ognev

Winter fur on back generally dirty drab with marked whitish mottling. Skull of the Persian squirrel very similar to that of anomalus. Coronal suture without the posterior processes characteristic of anomalus. Number of upper molars as in anomalus.

I examined two Syrian squirrels (Sciurus (Tenes) persicus syriacus Ehrenb.), one from Syria and the other from Palestine. The animal closely resembles the Caucasian squirrel. Color of underparts lighter and yellower. Tips of hair on tail yellowish. Mottling on back in winter fur more whitish than in anomalus. The Syrian squirrel is intermediate between anomalus and persicus. This is well shown by the Palestinian specimen in the ZMAN.

428 In my opinion, squirrels of the group persicus-anomalus should be considered as one species with several subspecies. This would also correspond to the zoogeographical data. The Persian squirrel should include the following subspecies: Sciurus (Tenes) persicus persicus Erxl. (Gilan Province), S. (Tenes) persicus anomalus Gmel. (Transcaucasia), S. (Tenes) persicus syriacus Ehrenb.* (Syria, Palestine), S. (Tenes) persicus fulvus Blanf. (Shiraz, Southern Iran).

The color of S. (Tenes) persicus anomalus Gm. is the most saturated, and its range is the most northern. The subspecies becomes markedly lighter towards the south. Syriacus and fulvus are especially light.

GEOGRAPHICAL DISTRIBUTION. Widely distributed in Transcaucasia, along the southern slopes of the eastern part of the Great Caucasus, throughout the Little Caucasus and in Western Transcaucasia (in the Artvin District). K.A. Satunin (1920) thinks that the range corresponds with his zoogeographical division of Caucasia, that is the "forest district of Eastern Transcaucasia". According to more recent data, S. persicus anomalus also occurs in the "West Transcaucasian" district to use K.A. Satunin's terminology. S. p. anomalus is absent in a large part of the forest district of Eastern Transcaucasia in its southeastern and northeastern parts. It does not occur on the Northern Caucasus. This is discussed in detail by E.A. Büchner ("Bulletin de l'Académie Imperiale de Saint-Petersbourg", Nouvelle série, I (XXXIII) 1890, pp. 125-132). All reports of the occurrence of squirrels on the Northern Caucasus refer to Glis glis which is called "squirrel" or "small squirrel" by the local population.

The knowledge of the distribution of squirrels in Western Transcaucasia is very incomplete. G.I. Radde wrote on the distribution of squirrels in Svanetia: "Squirrels do not occur frequently here. In 1864 I took ten days to pass through the inaccessible ravine of the Ingur and Lakhamuli in Dzhvara. Over 70 versts (Svanetia - Mingrelia) I saw a squirrel only once, in a beech forest and not in a pine forest." ("Museum Caucasicum," 1899, I, p. 64).

K.A. Satunin (1920) writes on the distribution of the squirrel in the Sukhumi District: "On the way from Sukhumi to Andreevskoe in 1913, my son saw a squirrel near the road but did not succeed in catching it. He may therefore have been mistaken." K.A. Satunin does not give any information on the distribution of squirrels in Abkhazia. There are now specimens from Abkhazia in the ZMAN, from the southern slope of the ravine from Sukhumi to the Pskhu range, from the Kodor District and also from near the village Parneauty (collected by G.P. Adlerberg). Farther

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* Sciurus historicus J.E. Gray is a synonym of this form (Synopsis of the Asiatic Squirrels, Annals and Magazine of Natural History, 1867, p. 273).

429

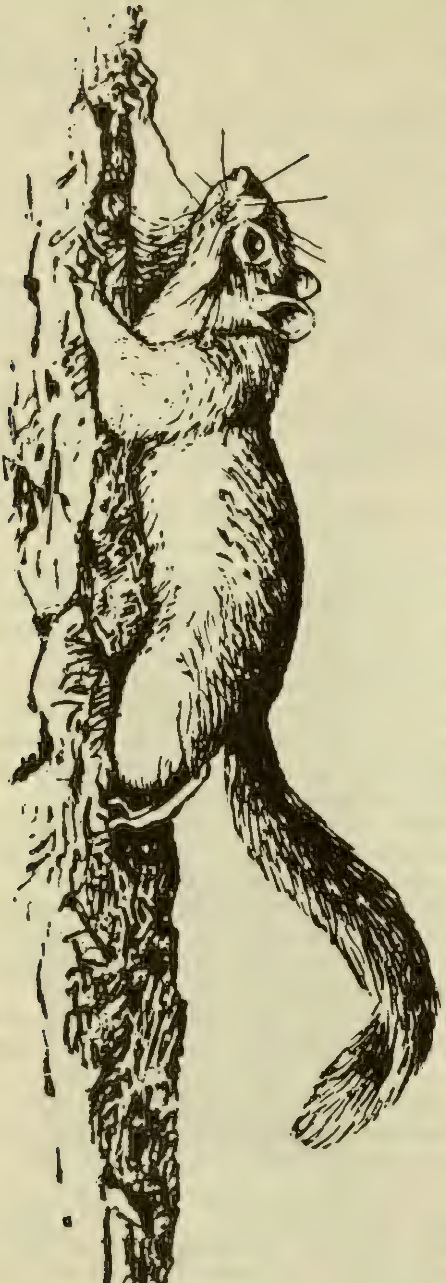


FIGURE 199. Sciurus (Tenes) persicus anomalus Gmel. Sketch from nature
Drawing by K. K. Flerov

south along the Black Sea coast, squirrels were observed near Ardanuch by K. D. Deryugin (K. A. Satunin, 1920). Specimens collected by P. V. Nesterov near Artvin and Gurzhan, former Artvin District are in the ZMAN collection. A. Nordmann (1840) recorded this species from Adzharia. We have no reports from the Kutaisi District, although it probably occurs there. It is common from the Surami Range eastward and occasionally in the former Tiflis Province (K. A. Satunin, 1920). He writes: "I once saw a squirrel in a garden in Tiflis in Mikhailovskaya Str., where, until recently, the gardens along the Kura formed a nearly continuous belt.

"In Kakhetia and the Zakataly District the squirrel is common and sometimes even numerous. My son caught two specimens near Lagodekhi. The squirrel is very common in central Transcaucasia, in the western part of Tiflis Province, along the eastern spurs of the Meskhiiskii Range and the mountains near it. I found large numbers on the Borzhomi Estate (villages Tori and Bakuriani) and in Ardanuch. In the east its range includes the forests at a similar height on the northern and eastern slopes of the Little Caucasus. I never found it on the southern slopes (Zangezur County) during two journeys in 1892 and 1912. Everywhere I found Glis glis L., but no squirrels."

430

In the ZMAN collection are specimens of Caucasian squirrels from the vicinity of Zakataly and Lagodekhi (collected by Mlokosevich). In my collection are specimens from the Zakataly District (collected by M. V. Shidlovskii).

We have no exact data on the distribution of the squirrel on the Talysh, except for the contradictory observations by G. I. Radde.

MODE OF LIFE. Beech forests are the main habitat of the Caucasian squirrel. It avoids pine forests with underbrush, and prefers forests with high trees.

The habits of the Caucasian squirrel resemble those of the common northern squirrel. According to K. A. Satunin, the sight, hearing and sense of smell are highly developed. Its choice of food indicates that its taste is developed. According to Satunin, the voice of the animal is sharp, metallic and sounds like "chit-chit-chit". It gives voice immediately when in danger.

The squirrel is active throughout the day. It climbs rapidly on trees. During stops it holds itself to the bark with the claws of all feet. The Caucasian squirrel leaps from branch to branch making jumps of 3-5 m. 431 The tail plays an important part, acting as a parachute. Satunin writes: "I sometimes observed that when the animal arrived in an unknown place, it climbed to the crown of a tree or onto a broken branch so that it could have a wider view. It sat for a long time in the same place, surveying the area as if considering its future actions."

The Caucasian squirrel is an excellent swimmer but does not like to enter water.

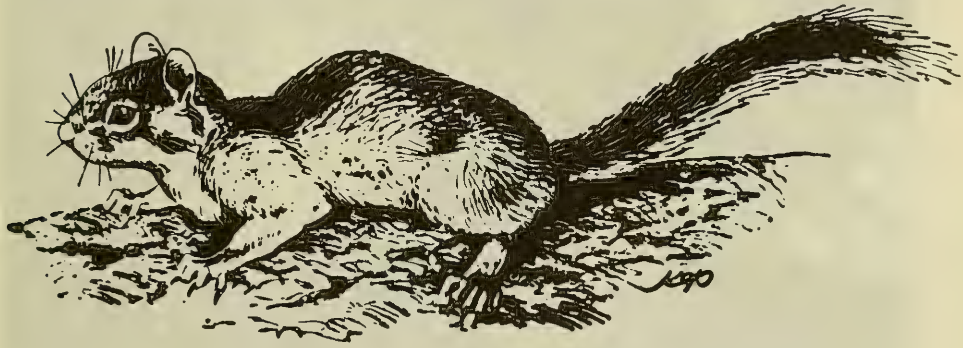


FIGURE 200. The Caucasian squirrel

Drawing by K. K. Flerov

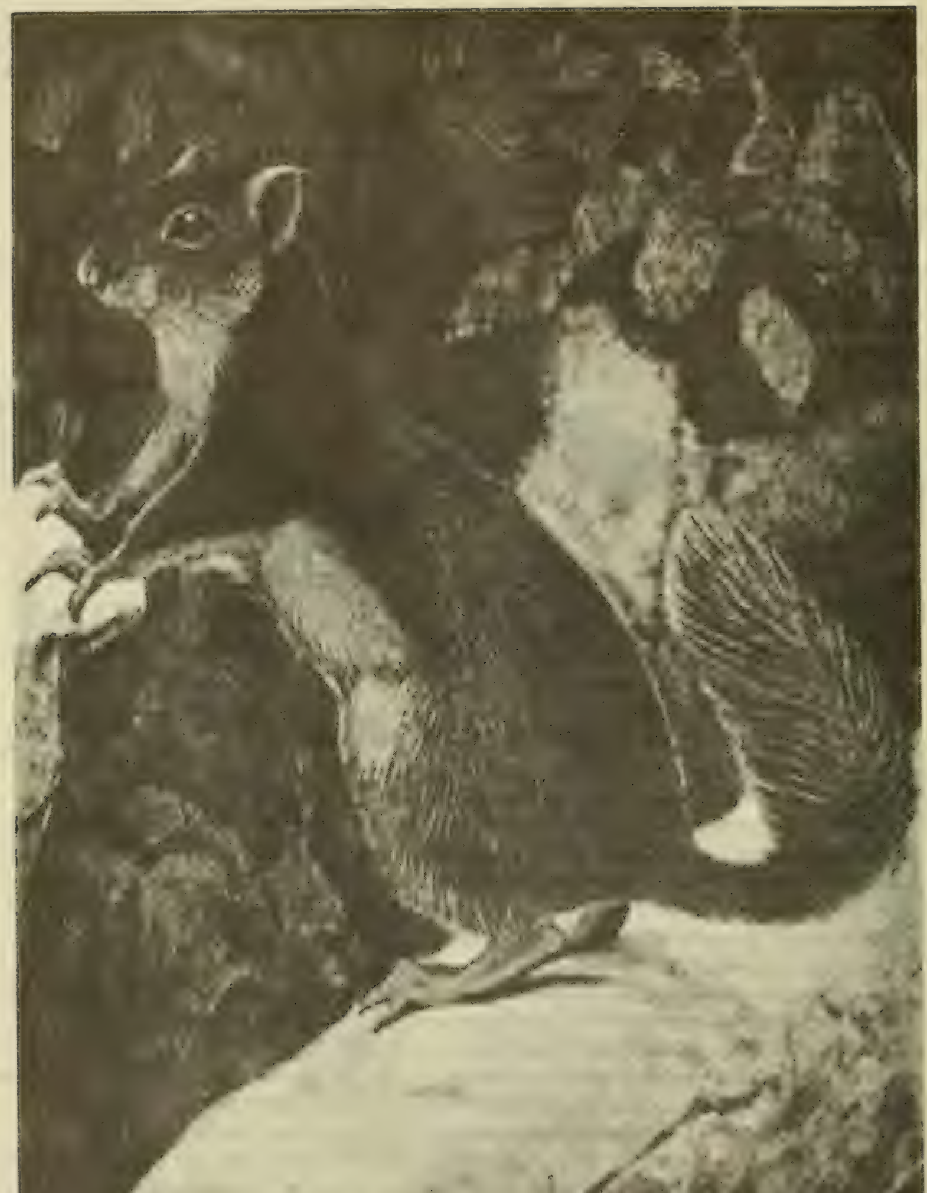
It usually feeds on nuts, mainly the Persian walnut, chestnuts, acorns, hazel and beech nuts, seeds of fruit, and berries. As it lives mainly in beech forests, beech nuts are apparently its main food. Satunin writes: "In Tiflis I once saw a squirrel on a tree with ripe apricots. The animal tore away the juicy pulp and discarded it to reach the stone which it ate like a nut."

According to K. A. Satunin the Caucasian squirrel collects large stores of food for winter, mainly nuts. These are hoarded in hollows in trees, clefts, burrows among the roots of trees, etc.

The Caucasian squirrel may rarely eat eggs in nests of small birds, and even nestlings. Non-Russian scientists accuse the Russian common squirrel of this. However, such cases are rare and isolated.

K. A. Satunin writes: "As far as I know squirrels do not build nests in Caucasia, but live only in hollows of trees. According to L. L. Mlokosevich, squirrels near Lagodekhi live in elms (Ulmus), linden (Tilia) and maple (Acer insigne), rarely in oak. The nests are built of moss, dry leaves 432 and other material. The same hollow is used for many years. L. L. Mlokosevich found squirrels for more than five years in the same elm tree."

According to the literature, the Caucasian squirrel has 3-7 young. L. L. Mlokosevich found only 3 young in the nests. According to



The Caucasian squirrel, Sciurus (Tenes) persicus anomalus Gmel.

Drawing by V. A. Vatagin

K. A. Satunin (1920) gestation lasts 3-4 weeks, but I doubt this. By analogy with the common squirrel, the gestation period cannot last less than a month. According to K. A. Satunin, in Transcaucasia the young are born in April.

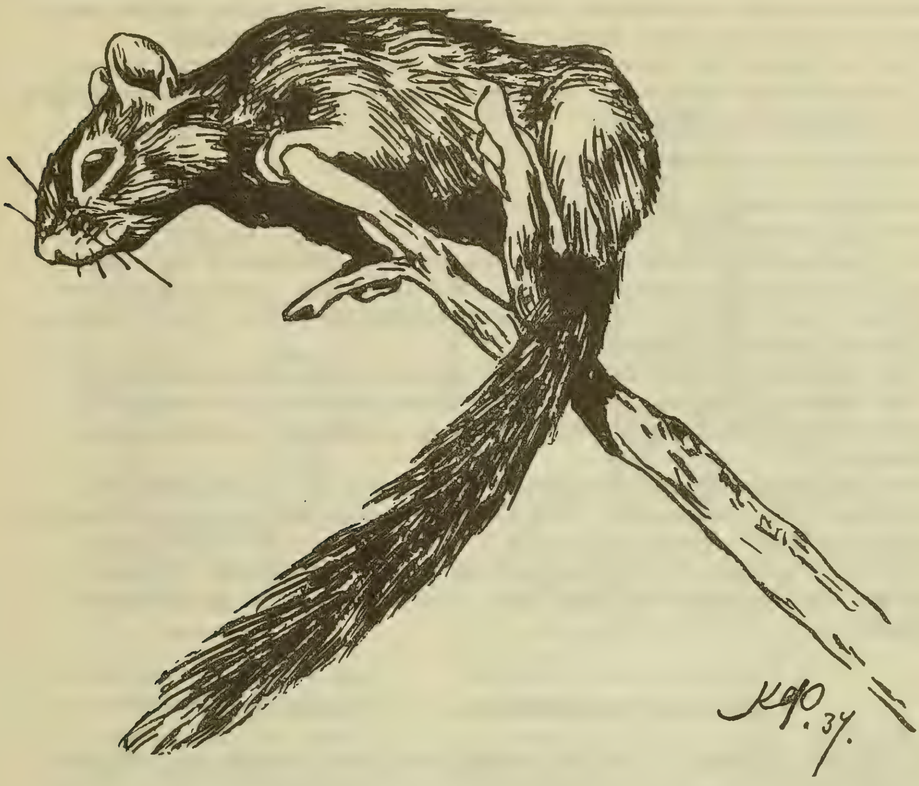


FIGURE 201. The Caucasian squirrel

Drawing by K. K. Flerov

The Caucasian squirrel is of little commercial value. Until the First World War the animal was not hunted. According to B. A. Kuznetsov, several hundred skins were collected between 1930-1932, but commerce has much increased and up to 30,000 pelts are now collected per year

Subfamily SPERMOPHILOPSINAE

Animals living in sand deserts. Back of uniform color.

Ears very short forming only small folds around the openings.

433 Tail less than half the length of the body, covered with moderately long hair.

Toes unusually long and slender. Second and fourth toes of hind feet longest and of about equal length. Second and third toes of forefeet of about equal length, the third slightly longer than the second.

Claws black, very long. Longest claws usually longer than 1 cm (up to 1.5 cm).

Cheek pouches not developed.

Crowns of molars inclined outwards, more or less rounded. Enamel pattern of crowns complicated, lophodont. Crowns of upper molars with transverse plicated loops, their rounded part directed inwards.

The surface of the molars also with two rounded-oval enamel areas, the anterior larger and better developed than the posterior. Lower molars with more bunodont structure.

Dental formula of molars: $p\,\frac{2}{1}$; $m\,\frac{3}{3}$.

Glans penis with a large carinate, laterally compressed process, its tip inclined downwards (Figure 208).

The carinate tip of the glans is more strongly flattened at the right side. It is laterally widened, and inclined to the left. The structure of the glans penis of Spermophilopsis resembles that of Geosciurus (Subfamily Xerinae) (Figure 209).

The geographical distribution of the subfamily has been given above.

The subfamily Spermophilopsinae is closely related to the African subfamily Xerinae, from which it differs in cranial and morphological characters.

The anatomy of Xerinae and Spermophilopsinae should be studied to determine their relationship. A preliminary study of Spermophilopsis and Xerus was recently made by B.S. Vinogradov (1936) who showed that there is a close resemblance between these two genera. It would, however, be premature to place Spermophilopsis in the subfamily Xerinae.

Genus **Spermophilopsis** W. Blasius (1884)

1883. Arctomys Lichtenstein H., Naturhist. Anhang in Eversmann's Reise nach Orenburg und Buchara, S. 119.

1827-1834. Citellus Lichtenstein H., Darstellung neuer Säugethiere, Taf. XXXII.

1852. Spermophilus Brand J. F., Zool. Anhang in A. Lehmann's Reise nach Buchara und Samarkand, S. 303.

1884. Spermophilopsis Blasius W., Über eine bisher zu den Zieseln (Spermophilus) gerechn. vermutl. neue Nagetiergattung aus Turkestan, Tageblatt der Natur. Versamml. zu Magdeburg, Sect. Zool., S. 324/5.

434 The species of this genus are adapted to life in sand deserts.

Back of uniform color, pale, resembling the background. Tail less than half the length of the body, covered with dense fur.

Terminal part of tail black ventrally, the dorsal side black only at the margin of the tip (Figure 210).

Ears very short, forming only small folds. Ear tufts never present. Cheek pouches not developed. Vibrissae arranged as follows: 1) paired groups of long vibrissae on sides of muzzle; 2) paired groups of soft, white vibrissae at the upper lip; 3) at margin of lower lip; 4) paired groups under the eyes; 5) one vibrissa near the outer corner of the eye; 6) paired groups of four vibrissae on the cheeks behind and below the eyes; 7) a single group on the chin; 8) groups of eight vibrissae at the outer ventral margin of wrist; 9) one vibrissa on the outer side of antebrachium; 10) one pair on the chest; 11) another pair posterior to group 10; 12) two symmetrical vibrissae outside those of group 11; 13) symmetrical groups of one or two vibrissae widely apart at the sides of the belly, laterally and posteriorly to group 12.

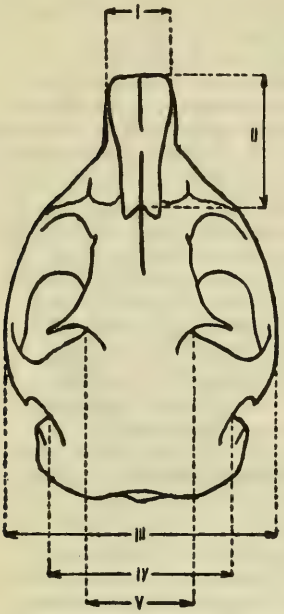


FIGURE 202. Measurements of skulls of Spermophilopsinae and Marmotinae

I — width of rostrum; II — length of nasals; III — zygomatic width; IV — temporal width; V — width of skull posterior to postorbital processes.

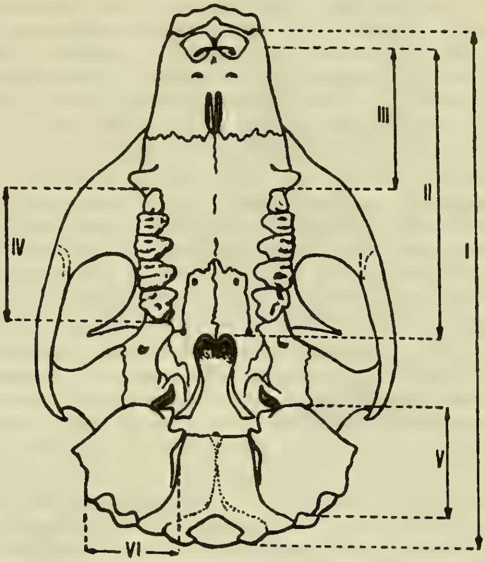


FIGURE 203. Measurements of skulls of Spermophilopsinae and Marmotinae

I — condylobasal length; II — length of bony palate; III — diastema; IV — length of upper tooth row; V — length of bullae osseae; VI — width of bullae osseae.

Drawing by Yu. A. Kostylev

Teats: p. 1-1; a. 2-2; i. 1-1. total 8.

435 Posterior processes of premaxillaries wide. Occipital part of each process as wide as both nasals in their posterior part.

Coronal suture rounded posteriorly, the middle part almost straight with two irregular, angular lateral processes.

Interorbital space very broad, about one third of condylobasal length.

Anterior part of frontal area flattened and slanting anteriorly. Posterior part slightly elevated with two small tubercles.

Brain case short and wide.

Anterior part of zygomatic arch at level of zygomatic process markedly elevated and widened, like in squirrels.

Infraorbital foramina very small, laterally compressed as in squirrels. Angular processes at the base of the infraorbital foramina.

Diastema about as long as upper tooth row.

Type species: Arctomys leptodactylus Licht.

GEOGRAPHICAL DISTRIBUTION. Northern Iran and Afghanistan, Transcaucasia and sporadically in the Kyzyl-Kum and Kara-Kum. An isolated area in the southern Balkhash Region.

166. Spermophilopsis leptodactylus Licht. (1823). Long-clawed ground squirrel

1823. Arctomys leptodactylus Lichtenstein H., Naturhist. Anhang zu Eversmann's Reise nach Orenburg und Buchara, S. 119.

NAMES: Das langkrallige Ziesel. Des dünnzehige Ziesel (German).

LOCAL NAMES: alaka (eastern Turkmenistan); alangart (western Turkmenistan); tishkan (Semirech'e, Dzhety Su); karakuiryuk [black tail] (Khiva Oasis, according to M. N. Bogdanov).

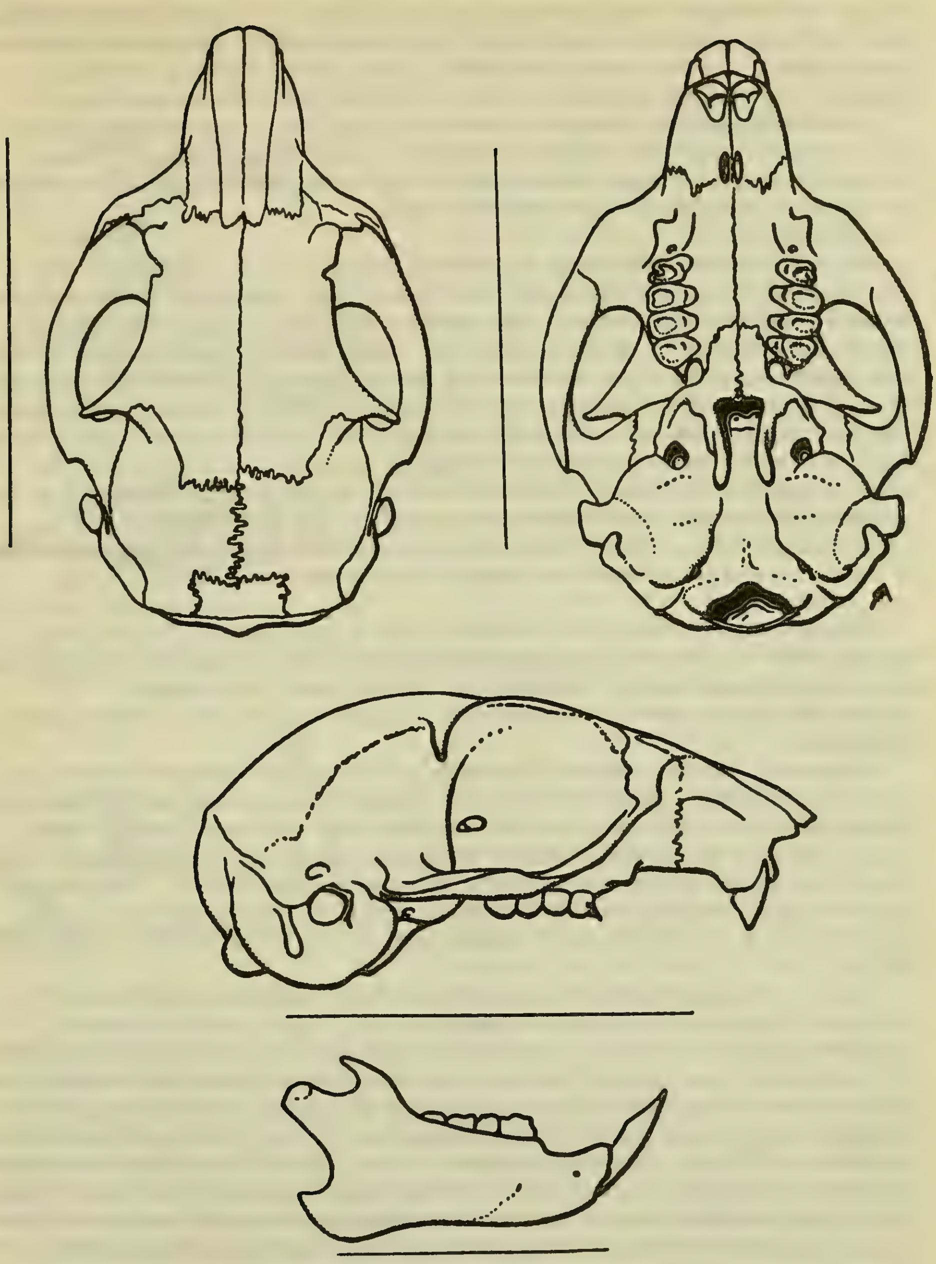
PRINCIPAL FIGURES: 1) Lichtenstein H., Darstellung neuer Säugethiere, Berlin, 1827-1834, Taf. XXXII; 2) Bogdanov M. N., Ocherki prirody Khivinskogo oazisa (Description of Nature in the Khiva Oasis), 1882, p. 26 (drawing of entire animal); 3) Fausek V., Biologicheskie issledovaniya v Zakaspiiskoi oblasti (Biological Investigations in Transcaspia), Zapiski po obshchei geografii Geograficheskogo obshchestva, Vol. XXVII, 1906, pp. 41-42, figs. 28-30 (structure of legs); 4) Bobrinskii N. A., Opredelitel' okhotnich'ikh i promyslovykh zverei (Key to Game and Commerical Animals), 1928, p. 44, fig. 28 (paws); second edition, 1932, p. 56, fig. 37; 5) V. G. Heptner, O melkikh pushnykh vidakh Turkmenii (Small Fur-Bearing Animals of Turkmenistan), Pushnoe delo, 1929, No. 8, pp. 58-64, fig. 1, p. 62 (running suslik), fig. 2, p. 63 (burrow); 6) Vinogradov B. S. and S. I. Obolenskii, Vrednye i poleznye v sel'skom khozyaistve mlekopitayushchie (Harmful and Useful Mammals in Agriculture), Moscow, 1932, p. 29, fig. 18 (drawing of entire animal from photograph of dead specimen); 7) Kashkarov D. N., Zhivotnye Turkestana (Animals of Turkestan), 1932, p. 16, fig. 4 (entire animal); 8) Lavrov N. P. and S. P. Naumov, Rasprostranenie i biologiya tonkopalogo suslika v Turkmenskoi SSR (Distribution and Biology of the Long-clawed Ground Squirrel in Turkmenia), Zoologicheskii zhurnal, XII (2): 81, fig. 1, 1933 (entire animal, sketch from photograph in nature); 9) Vinogradov B. A., Mlekopitayushchie SSSR. Gryzuny (Mammals of the U. S. S. R. Rodents), Leningrad, 1933, pl. IV, fig. VII (photograph of entire animal); 10) Serebrennikov M. K., Album osteurop., westsibirisch. und turkestanisch. Säugetiere, III, Ztschr. f. Säugetierkunde, Bd. VIII, 1933, Taf. III, Alb. 5
436 (entire animal); 11) Lavrov N. P. and S. P. Naumov, Stroenie mekha i lin'ka tonkopalogo suslika (Fur and Molt in Spermophilopsis), Zoologicheskii Zhurnal, XIII (2): 313, 1934. fig. 1 (hair structure); pp. 314-315, 317, 318, 323-324, figs. 2-9 (structure and arrangement of hair); p. 326, fig. 10 (molt); 12) Vinogradov B. S., Pavlovskii E. N. and K. K. Flerov, Zveri Tadzhikistana (Animals of Tadzhikistan), 1935, pp. 202-203, figs. 72-73 (entire animal, photograph of burrow); 13) Vinogradov B. S., Argyropulo A. I. and V. G. Heptner, Gryzuny Srednei Azii (Rodents of Central Asia), 1936, p. 23, fig. 1 (photograph of entire animal), p. 24, fig. 2 (head of young), p. 26, fig. 4 (skull), p. 27, fig. 6 (penis), p. 28, figs. 7-8 (teeth), p. 29, fig. 9 (photograph of habitat).

MATERIAL EXAMINED: 161 pelts and skulls.

DIAGNOSIS. Interorbital space very broad, more than 30%, of condylobasal length. Skull very broad posterior to postorbital processes. Width of skull at this level more than 40% of condylobasal length. Zygomatic width more than 75% of condylobasal length. Posterior part of nasal processes of premaxillaries very wide. Occipital part of nasal processes as wide as both nasals in their posterior part or a little narrower. Interparietal large and of varying shape, with well defined border. Bullae osseae very large and inflated. Their anterior part divided from posterior parts by a well marked transverse groove. Around the auditory meatus they form tubular processes. Length of upper tooth row less than length of bullae osseae. Crowns of molars rounded and with folds of the lophodont type. Diameter of first upper premolar 1/3 to 1/4 of that of second premolar (Figure 204-207).

Toes very long and slender. Second to fourth toes of hind legs longest and of about equal length; first toe long, only little shorter than fifth. Second and third toes of forefeet of about equal length and longer than the others; third toe little longer than second; first toe very small with well developed claw; fifth about half the length of the fourth. Claws very long, and black. Longest claws usually more than 1 cm long (to 1.5 cm).

Summer fur short, coarse, stiff and sparse, of yellowish buff-sand color, sometimes with a light rust tinge (intermediate between light pinkish cinnamon and cinnamon-buff, pl. XXIX). Fine gray-chestnut mottling sometimes present.



FIGURES 204-207. Skull of Spermophilopsis leptodactylus Licht. No. M.3214 male, 4 May 1925. Sands near Ashkhabad, S. I. Ognev's collection

Drawing by Yu. A. Kostylev

Winter fur (Plate X) very delicate, brilliant, silky. It color varies between rich buff-rust-sand tones and more rust-drab tones (light pinkish cinnamon, pinkish buff, cinnamon-buff, pl. XXIX). Fine drab-chestnut mottling present to a varying extent in winter fur of the different subspecies.

MEASUREMENTS. Length of skull 50-59.2 mm; condylobasal length 44.2-54 mm; zygomatic width 31-38.6 mm; interorbital space 13.4-20.1 mm; length of upper tooth row 9.8-12.2 mm. Body length 210-278 mm; tail length 43-102 mm; hind foot 49-67 mm.

Teats 8.

437 DESCRIPTION. The skull of Spermophilopsis resembles that of the squirrel, having a similarly wide interorbital space and area posterior to the postorbital processes. The same cranial characters distinguish Spermophilopsis from Citellus. The longitudinal diameter of the last upper molar is about half as long as the distance between the posterior margin of its alveolus and the anterior margin of the mesopterygoid fossa. The mandibula resembles that of the squirrel. It differs from that of ground
438 squirrels in its short and massive angular process. In Citellus the angular process is lower, its dorsal margin has a large notch and it is more inclined downwards, sidewards and backwards. The interparietal of Spermophilopsis is present as a separate one even in very old specimens. In squirrels and ground squirrels this bone is present only in very young specimens.

The skull of Spermophilopsis differs from that of the squirrel as follows: 1) postorbital process more posterior; 2) nasals narrower and less widened anteriorly; 3) posterior part of nasal processes of premaxillaries rounded; in Sciurus vulgaris they have outer lateral processes.

Crowns of molars inclined outwards and rounded. Enamel pattern of crowns lophodont. Upper molars with transverse plicated loops the rounded part of which is directed inwards. Surface also with two rounded oval enamel areas, the anterior better developed and larger than the posterior. Lower molars bunodont, especially the anterior premolars. The teeth of Spermophilopsis closely resemble those of African species of the genus Xerus (cf. M. Weber, Säugetiere, B. II, 1928, S. 257, Figure 172, III, V).

Color of summer fur on back and head light, uniformly buff-sand colored with a rust tinge (near cinnamon-buff, light pinkish cinnamon, pl. XXIX, sometimes with a yellowish, light ochraceous-buff tone, pl. XV). In specimens from Kushka the rust tone is more saturated and the hairs have better marked chestnut-brown bands which produce a fine mottling. Color of flanks lighter and yellower than that of back. Legs buff-sand colored. Soles dorsally paler and more whitish. Chin, throat and belly white. Hair in these areas white to the roots. Dorsal side of tail buff-rust-sand colored. Many hairs on the sides of the tail with blackish subapical bands and buff-yellow apices. The black subapical bands become broader and more intensely colored in the terminal part of the tail, where they form a subterminal black area with a whitish border. Ventral side of basal third of tail buff-sand-gray, remaining two thirds of tail black with a whitish fringe. Claws very long, black-chestnut, strong, slightly curved, with yellowish tips. Ears very short, consisting of short folds around the auditory meatus.

Winter fur sharply different from summer fur. Hair of underfur in summer very short, barely visible. The fur consists mainly of stiff, short guard hairs (i.e., guide hairs, guard hairs and intermediate hairs). The winter fur consists mainly of the underfur which is very soft and straight, wavy only on the hindquarters. Guard hairs of winter fur straight, stiff and elastic. The guide and guard hairs of the winter fur are more than twice as long as those of the summer fur. N.P. Raspopov and S.P. Naumov (1934) state that in winter the hair of the underfur on the back is nine times as long as that of the summer fur. On the other hand the guide hairs and guard hairs in summer are considerably thicker than in winter. The hairs of the underfur in summer are thinner than in winter fur. This is clearly shown in tables (p. 440).

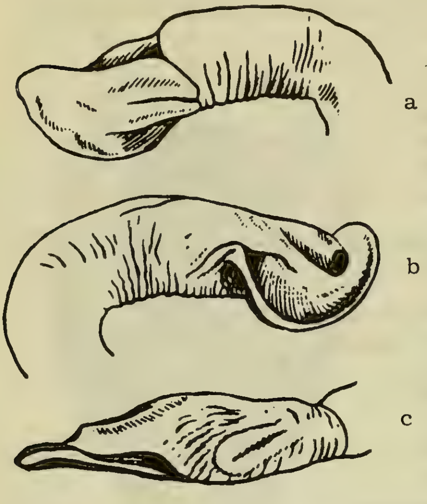


FIGURE 208. Penis of Spermophilopsis

a — left; b — right; c — dorsal (according to B. S. Vinogradov).

Winter fur much denser than summer fur. N.P. Lavrov and S.P. Naumov calculated the number of hairs per 0.25 cm^2 and obtained the following figures: 1) summer fur in middle of back, 475 hairs (217 guide and guard hairs, 258 intermediate hairs and hairs of underfur); winter fur in middle of back, 1241 hairs (132 guide and guard hairs, 1109 hairs of underfur); 2) winter fur in middle of belly, 1962 (1075 guard hairs and guide hairs, 887 hairs of underfur); summer fur in middle of belly, 155 (69 guard hairs and guide hairs, 86 intermediate hairs and hairs of undercoat). Winter fur on back three times as dense as summer fur, on belly six times as dense as summer fur. Color of winter fur varying according to locality. The palest specimens occur in the Central Kara-Kum. The
440 general color of the back of these specimens is brilliant rust-sandy-gold (cinnamon-buff, pl. XXIX). Flanks paler (pinkish buff, pl. XXIX). Belly white. The color of guard hairs in these specimens as follows: roots depigmented, followed by a short blackish gray band, a whitish central band and a rust-yellow tip. Tips of many hairs whitish yellow.

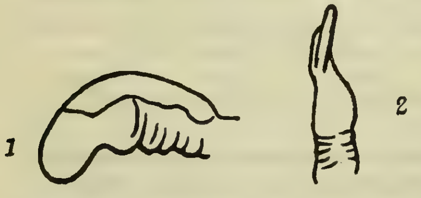


FIGURE 209. Glans penis of Euxerus erythropus

1 — left; 2 — ventral (according to R. Pocock).

Length of winter hair in mm (average)

Guide hairs			Guard hairs			Underfur		
Middle of back	Buttocks	Middle of belly	Middle of back	Buttocks	Middle of belly	Middle of back	Buttocks	Middle of belly
18.1	20.9	20.5	12	12.7	15.9	9.2	9.8	10.9

Thickness of winter hair (in μ)

Sampling zone	Type of hair	Thickest part of hair	Middle of hair	Thickness of base
Middle of back . . .	Guide hairs	73.1	27.5	38.4
	Guard hairs	83.2	29.2	34.2
	Underfur	13.4	21.7	19.2
Middle of belly . . .	Guide hairs	64.6	29.6	38
	Guard hairs	49.4	23.7	33.1
	Underfur	25	19.3	18.5

Length of summer hair (in mm)

Type of hair / Zone from which the measurement was taken	Guide hairs	Guard hairs	Intermediate hair (1st type)	Intermediate hair (2nd type)	Underfur
Middle of back	8.5	5	2	1.4	1
Middle of belly	7.5	6.5	3.5	0.9	Absent

Thickness of summer hair (in μ)

Type of hair / Zone from which the measurement was taken	Guide hairs	Guard hairs	Intermediate hair (1st type)	Intermediate hair (2nd type)	Underfur
Middle of back	150	103	35.7	20.5	9.7
Middle of belly	90	77.5	57.5	17.5	Absent

441 Top of head and back in specimens of the yellow color type buff-yellow-gray darkened by the black-chestnut subapical bands of the hair. Flanks purer rust-buff-yellow. Throat, neck and belly white. Color of individual guard hairs as follows: roots depigmented, followed by narrow blackish bands, whitish middle parts which become more rust-colored and yellow distally, well marked black-chestnut subapical bands and buff-yellow-rust hair tips. Shape of winter guard hairs as follows: proximal 3/4 straight, not thicker proximally; terminal 1/4 of hair arrowlike or lanceolate. Color of winter fur more golden and lighter than summer fur.

Color of young summer specimens different from that of adults, paler and almost without any dark mottling. Fur very pale, delicate, yellow-sandy, sometimes with a light pinkish tinge (between pinkish buff, pl. XXIX and vinaceous-buff, pl. XL).

The number and arrangement of the vibrissae are constant throughout the year. They are very distinct on the short and coarse summer fur. In winter, the vibrissae can be found only by careful examination of the fur in previously known places. Spermophilopsis has a great variety of vibrissae arranged in the following order. On the head: 1) paired groups of 18-22 vibrissae on lateral part of the muzzle and between nose and eyes; these vibrissae are called whiskers and they are 1.5-35 mm long; the shortest are near the nostrils and the longest at the sides, above the upper lip; 2) paired groups of soft white vibrissae along the margin of the upper

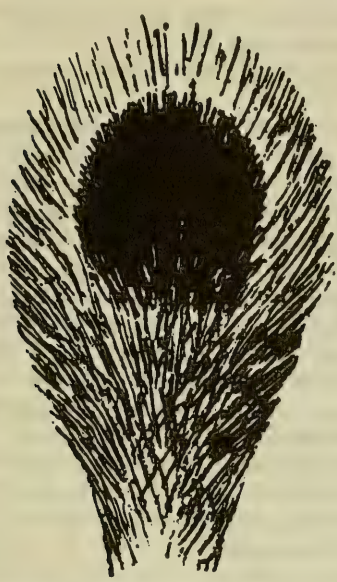


FIGURE 210. End of tail of Spermophilopsis (ventral)
Drawing by A. N. Formozov

lip; each group consists of 10-15 hairs 0.7-3 mm long; 3) single groups along the margin of the lower lip; dense paired groups above the eyes, each consisting of 6-10 (generally 7) hairs 7-20 mm long; 5) one long vibrissa, 13-21 mm long near the outer corner of the eye; 6) paired groups of 4 hairs on the cheeks, posterior to and below the eyes; 7) a single group on the chin, consisting of 3-4 vibrissae 20-22 mm long. On the forefeet: 8) groups of 8 hairs 11-21 mm long on the outer ventral side of the wrist; 9) one long hair (20-25 mm) on the external surface of the antebrachium. On the body: 10) a pair of symmetrical vibrissae on the chest, 23-26 mm long (in females, these vibrissae are between the first and second teats); 11) a pair of vibrissae, 23-24 mm long, posterior to group 10; 12) two symmetrical vibrissae, 15-16 mm long, lateral to group 11; 13) 1 or 2 vibrissae 18-23 mm long on the belly posteriorly and laterally to group 12. These vibrissae are at the sides of the belly in females, lateral to the 2nd teat. N.P. Lavrov and S.N. Naumov (1934) state that concentration of the vibrissae on the underparts is 442 characteristic for Spermophilopsis. Four pairs of vibrissae on chest and belly. Sciurus vulgaris has only two abdominal pairs of vibrissae, only rarely three pairs (according to I.D. Kidris).

The legs of Spermophilopsis are very typical. The soles of the forelegs in summer fur are covered with sparse fur through which large calluses are visible at the base of the toes. Stiff pectinate fringes of hair (5 mm long) grow along the outer margin of the sole, the lateral margin of the fifth toe and part of the sole. Such fringes of white, flexible hair grow also on the inner sides of the second toes. Hind soles with dense, thick fur which reaches the base of the toes. Heels covered with dense fur. Calluses of soles concealed by hair. Outer margin of hind feet with a well developed pectinate hair fringe. Its hairs are especially long at the tip of the fifth toe, forming a tuft along the claw which is longer than the claw itself. Shorter hair fringes at the inner margin of the first toes. In winter fur, the hair cover of the soles is better developed and the calluses of the soles of the forefeet are almost completely covered with white hair. The feet of Citellus fulvus, which is ecologically related to Spermophilopsis, are bare. The tufted soles of Spermophilopsis are apparently an adaptation to the hot sand. S.P. Naumov and N.P. Lavrov (1934) state that the bare-soled C. fulvus lives mainly on fixed sand, and even more often in steppes where the soil is cooler because of the rich vegetation. Furthermore, C. fulvus goes into aestivation in summer when the ground is very hot.

The hairy fringes of the toes are important. When the animal walks or runs on the sand they stretch sideways, enlarging the supporting area and preventing it from sinking into the loose sand.

SYSTEMATIC NOTES. In addition to specific characters, the skull of Spermophilopsis has much in common with that of the squirrel. Spermophilopsis is closely related to the African Xeridae in the structure of the skull and the stiff hair of its summer fur. There are, however, some differences in the form of the skull. The distribution of vibrissae has been described above. The morphology of Spermophilopsis proves that it is systematically far removed from true Citellus.

GEOGRAPHICAL DISTRIBUTION. The northern boundary of the range in the west passes north of the Krasnovodsk spit, south of Kara-Bogaz-Gol Gulf. Farther east it occurs throughout the Chil'-Mamed-Kum Desert. Further on the boundary is not known and then it passes into the Tashgauz 443 (on the Amu Darya). According to M.N. Bogdanov (1882), the northernmost occurrence of this species in the Kyzyl-Kum is a locality near Irkibai, near the Yana Darya river. It has not been found so far in the valley of the Chu river. The habitat of the animal in the Dzhety Su is possibly separated from its range in the Kyzyl-Kum. According to V.N. Shnitnikov (1917), Spermophilopsis occurs on the shore of Lake Balkhash (between 46°30' and 47°10' N) and also on the Karatal between the Ili river and the Karatal. The southern part of the range includes the southern parts of Turkmenia and apparently the Asterabad Province in Persia. In the southeastern corner of Turkmenia Spermophilopsis occurs near Kushka, Kerki and in northern Afghanistan. There are unfortunately no exact data on this southern boundary.

According to S.P. Naumov and N.P. Lavrov (1933), Spermophilopsis apparently occurs throughout the Dardzha Peninsula. They found it in the eastern part of the peninsula. Radde and Walter (1890) recorded it from near the Mikhailovo fortifications. It also occurs on Cheleken Island. According to V. Levchuk (1906), it is common in the sands on this island. According to furriers (1933), Spermophilopsis apparently occurs throughout the Dardzha Peninsula. They found it in the eastern part of the peninsula. Radde and Walter (1890) recorded it from near the Mikhailov fortifications. It also occurs on Cheleken Island. According to V. Levchuk (1906), it is common in the sands on this island. According to furriers (1933), Spermophilopsis occurs throughout the sands south of the Dardzha Peninsula, to the south of Chikishlyar. It is common in the vicinity of Kara Kala. According to N.P. Lavrov and S.P. Naumov (1933), the animal is absent south of these 444 regions, in the southwestern corner of Turkmenia, between the railway, the Caspian Sea and the Atrek river. It occurs only sporadically in sandy and sandy-loamy areas in this region. In the northwestern parts of its western range, N.P. Lavrov and S.P. Naumov found it in the central part of the Krasnovodsk spit. They write: "Spermophilopsis is distributed throughout the Chil'-Mamed Kum sands, according to our observations in the western part of this region, and reports of fur trappers and Turkmens from its eastern part." According to M.N. Bogdarov (1882), it lives in the Kyzyl-Kum desert as far as the Syr Darya in the north, though it does not reach this river in many places. The northernmost record during M.N. Bogdanov's expedition was the Koskuduk well west of Irkibai, 2 km from from the Yana Darya. It is numerous on sand farther south as far as the Amu Dar'ya. It is common in the Kyzyl Kum, Dzhaman Kum and the sands between the Murun (near Aristanbel - Kuduk) and Uch-Uchak. On the left side of the Amu Darya it occurs in the sands to Kum' Daryalyk, near Tashaus and Kun'-Urgench. It is absent on the Mangyshlak, Ust'Urt, in the Barsuks, the Sam sands, the Astantai-Mantai, Isen Chagyl. N.P. Lavrov and S.P. Naumov (1933) give detailed information on the distribution of Spermophilopsis in Turkmenia: "It apparently occurs throughout the Kara-Kum... It was found at the southern outskirts of the Kara Kum between Akhch Kuim in the west and Chardzhui in the east. In the center of the Kara Kum at the line Ashkhabad - Ierbent - Sernye its mounds are everywhere except in the low cultivated land along the railway. L.M. Shul'pin informed us that in 1930 he found Spermophilopsis all along the way in the central Kara Kum, north of the Bashi railway station. Furs are processed in Darganat and Tatauz in the northern parts of the Kara Kum.

"In the southeastern Kara Kum, that is, the area between the Tedzhen river and the Amu Dar'ya, and between the railway and the border, Spermophilopsis was found in the following places: K.K. Flerov found it near the railroad stations of Teshkepri, Takhta-Bazar and Kushka on the Kushka branch-line. According to fur-trading companies, it occurs near Iolotan and Seraks. Shnitnikov recorded it from Kerkov. We found it south of the Uchadzhi Station.

"It is still not known whether it occurs in the sands of the southern part of of the above region. According to the forester N.I. Pustyshkin (of the Chimchakly District), susliks of more northern areas, Uch-Adzhi and Chimchakly, inhabit sand dunes. It may be assumed that they also occur in the sand dunes of the southern region.

"They are absent in the greater part of the southwestern corner of Western Turkmenia (bordered by the railway, the Caspian Sea and the Atrek river). They occur only sporadically in sand and sandy-loamy patches. The species is also absent in most of the northwestern corner of Turkmenia,
445 which is higher with a pebbly-stony soil. It is not found in most of the cultivated, irrigated plain at the foot of the Great and Little Balkhans and the Kopet Dagh. This plain is narrow, but widens in the Tedzhen and Mary oases. Along rivers it forms extensions northward and southward. The animal is absent in localities along the Amu Darya."

In 1925, V.G. Heptner and I found large numbers of Spermophilopsis on sands near Ashkhabad and the Annau station. It is widely distributed in Buchara. The species was described by Prof. Lichtenstein from a specimen collected by Prof. Eversmann near Kara Ata, 140 km from Bukh. N.M. Dukel'skaya (1926-1927) found it in the Karakul District (Zeravshan Region). N.A. Bobriskii found it in southern Buchara. In the ZMAN collection are skins from Khadzhi Davlet, Karakul, Bogoabdal (Buchara), Lower Pyandzh, Iman Baba (Mugrab), Bii Kal on the Amu Darya (Buchara). V.N. Shnitnikov (1917-1936) reports that in Semirech'e the species is distributed along the shore of Lake Balkhash in the former Kopal County (between 40°30' and 47° N). Small colonies live on the right bank of the Karatal, in the Tantabai area (46° N and 47° E) and also in various localities between the Ili river, Karatal and the shore of Lake Balkhash. The animal occurs sporadically and in small numbers in these localities.

MODE OF LIFE. Spermophilopsis lives mainly on sand. In the vicinity of Ashkhabad the sand hills reach as far as the arid semidesert. Spermophilopsis keeps to the sand in this region, not entering the semidesert. However, the range of Spermophilopsis is not restricted to sands. N.P. Lavrov and S.P. Naumov (1933) found it on soil without any sand, but they found it mainly on sand (sand dunes). They also found it in pebbly-loamy foothills and clayey-sandy plains. Spermophilopsis inhabits areas with solid soil only in the vicinity of sand.

Spermophilopsis does not occur in takyrs, solonetz* regions, clay-Artemisia steppes and mountain-Artemisia steppes.

The animal is cautious and timid. It does not let man approach to within shotgun range. It apparently has good sight, as it notices danger from afar. It is silent; I heard its voice only once, when, surprised it gave a chirping cry and buried itself quickly in the sand. It may move as far as 500 steps from its principal burrow. S.I. Ognev and V.G. Heptner (1929) write: "It bounds along with outstretched feet, raising its hindquarters and holding its tail upwards. Its movements are intermediate between those of the squirrel and the hare and do not resemble those of the
446 Russian susliks which run close to the ground. When escaping from a hunter, it tries not to lose sight of him. Having reached the top of a dune it pauses, rises on its hind feet and raises its tail. The white color of its underparts can then be seen from a long distance making it possible to see the animal which is otherwise invisible because of its color which matches the sandy ground. After looking about, the animal runs away, pausing again on the next dune to have another look. The animal makes several such inspections until it reaches its shelter. There it stops for a moment and then enters. It spends a long period in the shelter and does not come out again without making sure that there is no further danger."

We studied the daily life of Spermophilopsis near Ashkhabad in the spring and early summer of 1925. We found that the animals come out late in the morning when it is already warm, and remain active until noon. During the hottest part of the day they remain in their burrows. They reappear towards evening, when the heat has subsided, but they are much less numerous, less active and more cautious than in the morning.

N.P. Lavrov and S.P. Naumov (1933) provide detailed data on the daily life of susliks in Turkmenia during different months. In the second half of February they rarely came out of their burrows, showed little activity and did not move more than 10-15 m from their burrows. Their daily activity began at about 10 a.m. In the evening they returned to their burrows at 5-6 p.m. (in clear weather and a temperature of 12-15°).

In the last days of February the weather was clear and warm. The temperature rose to 20-25°. The animals were more numerous, they moved from their burrows and returned at 7 p.m. In late March the animals began to come out at 9 a.m. and remained outside until 11-12 a.m. After midday the number of animals outside decreased, and increased again only after 4-5 p.m. The animals sometimes moved 200 m from their burrows. N.P. Lavrov and S.P. Naumov observed that the animals began to come out earlier in late spring. In the middle of April they appeared at 6-7 a.m. In May D.N. Kashkarov (1929) saw them in the central Kara-Kum as early as 5 a.m.

According to observations by V.G. Heptner and myself (1925) near Ashkhabad, the burrows of Spermophilopsis are wider than burrows of European susliks. They are located mainly on slopes of dunes, either on bare ground or under plants of Aristida pennata. Burrows are also often built in soil cultivated with cereals, Peganum harmala and Sophora pachycarpa. They do not inhabit typical solonetz, but their burrows may be near such soils. In front of the burrow is a heap of excavated sand.

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* [A type of alkaline soil.]

447 N.P. Lavrov and S.P. Naumov (1933) write: "Spermophilopsis lives mainly on sand hills and in depressions covered with silt and surrounded by hillocks or barchans. Sandy soil is not necessary for burrowing. Near the Sernye hillocks and the Dzhebel station we found small numbers in the foothills. This is a plain consisting of solonetz serozems with debris-gravel deposits and a small admixture of sand.

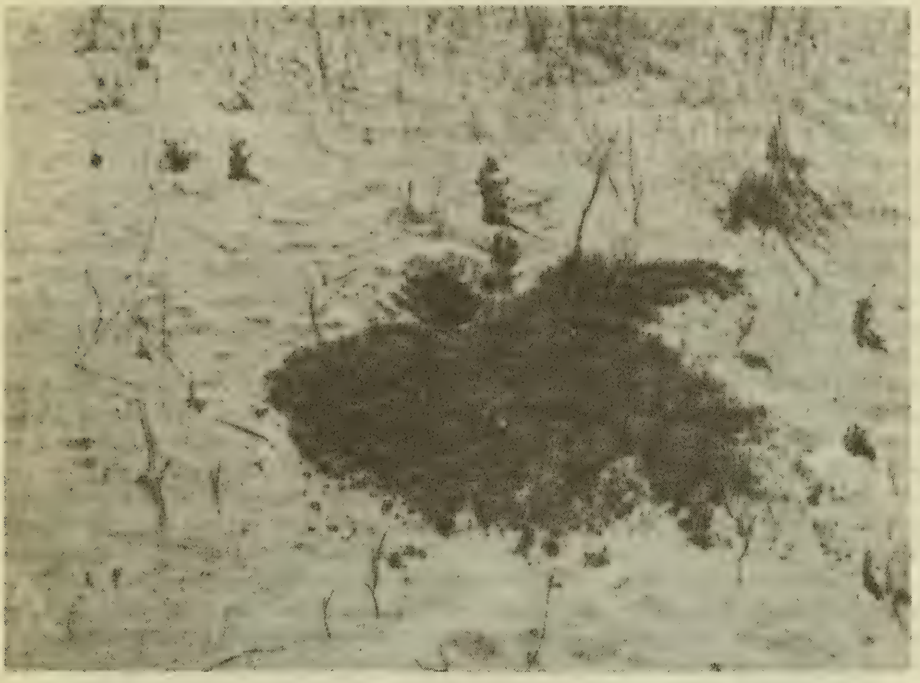


FIGURE 211. A burrow of Spermophilopsis in the desert near Ashkhabad

Photograph by S. I. Ognev

"Four kilometers west of the Dzhebel station we found a colony of Spermophilopsis on the Uzboi, close to a salt lake. The burrows were on the slope of the bank among dense thickets of tamarisk, Elaeagnus, Caragana and willow... On the opposite shore of the lake Spermophilopsis lived in a plain of sand mixed with fine earth and rubble.

"The more fixed the sands were, the more numerous were burrows on slopes and hillocks, and the less numerous in valleys and depressions.

"In places with few shrubs the entrances of the burrows are usually under shrubs of Haloxylon, Calligonum etc., which apparently protect the burrow against damage and the animal from its enemies.

448 "On hillocks in the western part of the Krasnovodsk spit all entrances were directed NE - SE. This is apparently related to the winds which usually blow from the west.

"Most burrows have one entrance. We rarely found burrows with two or more entrances." These authors did find burrows with three and even four entrances. The burrows are very complicated. Lavrov and Naumov continue: "We excavated a burrow on 28 February, 1932 near the Dzhebel station, south of the railway. It was on a small, sand hillock about 1 m high, and had two entrances which were under a small Salsola arbuscula, 3.5 m apart. The main gallery was 4.8 m long and went through the hillock horizontally. It had lateral galleries which branched and rejoined the main gallery. Some lateral galleries descended or ascended, ending blind. These blind ends were always more than 28 cm below the surface. The galleries were usually 6-8.5 cm wide and the blind alleys 5-5.5 cm. The branches or junctions of two or more galleries formed chambers, but there were no nests. These chambers were about 15 cm wide. The burrows contained only a few old stalks of Carex physodes and Calligonum seeds. No remnants of food or feces were found near the burrow. There was only a heap of sand in front of the entrance.

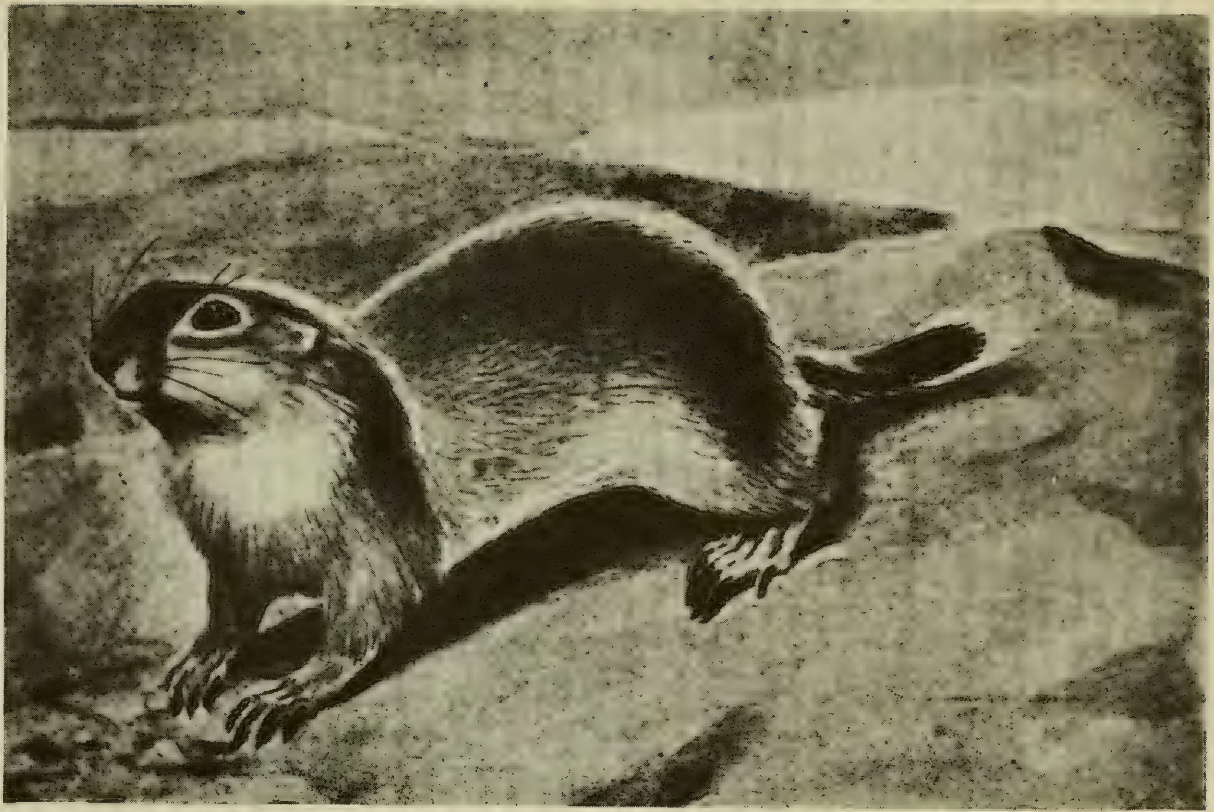
"Another burrow was excavated on 5 April near the Uch Adzhi station. This was in a depression densely overgrown with Carex and surrounded by mounds. The burrow had one entrance 12 cm wide and 8.5 cm high. Lateral galleries, 17 cm wide, branched off in both directions 0.5 m from the main gallery. The main gallery then became 27 cm wide but its height remained the same. At a distance of 3.5 m from the entrance the main gallery ended in a broad chamber the ceiling of which was 13 cm below the surface. The lateral galleries had blind ends at least 37 cm below the surface, the deepest being at 120 cm. We found a few seeds of Calligonum and Haloxylon and capsules and stalks of Carex in the burrow. We also found some feces of sheep which had apparently been introduced into the burrow by accident. We did not find any nests."

In addition to these permanent burrows, N.P. Lavrov and S.P. Naumov often found temporary burrows. They dig them in various places, generally in loose sand. They use these dwellings only for a short time, for one night or for some hours during the day. The temporary burrows are apparently used by specimens which have moved far away from their principal burrow. The number of temporary burrows is in inverse proportion to the amount of food in a place. The greatest number of temporary burrows is found in loose sand. They are less numerous in fixed sand. It is difficult to determine the number of temporary burrows as they are easily destroyed in the loose sand.

It is thus difficult to determine the number of Spermophilopsis in
449 an area. Many burrows have to be considered as temporary, i.e., not inhabited. N.P. Lavrov and S.P. Naumov (1933) observed the greatest number of inhabited burrows in places with plenty of food plants. Thus in late February 1932 almost 100% of the burrows near the Dzhebel station were inhabited. In good weather, the ground squirrels could be observed near almost all burrows. Where food was poor only 70% and in some places only 20-30% were occupied. According to B.S. Vinogradov (1936), crickets (Phyllobothrium vlassovi) are common in the burrows.

According to V.G. Heptner (1929), in spring Spermophilopsis feeds mainly on Carex physodes, digging the rhizomes out of the sand. Burrows are everywhere during this time. Towards May the desert becomes scorched, Carex has seeds, and Spermophilopsis has to

PLATE X



Spermophilopsis leptodactylus Licht. in winter fur

Drawing by V. A. Vatagin

go far from its burrow for food. Later, it feeds on *Artemisia*, which remains green even in July. The animal also eats shoots of conifers. Fruits of various shrubs (e.g., *Calligonum*) become more important as food in summer. In winter the animal feeds only on such fruits, and climbs on the shrubs to obtain them. *Spermophilopsis* feeds on parts of plants in the soil throughout the year. It is especially fond of the rhizomes of *Carex*. It may occasionally take animal food, e.g., beetles. In D.N. Kashkarov's opinion, the main food of the animal is tubers of *Poa bulbosa*. N.P. Lavrov and S.P. Naumov (1933) observed that bulbs of *Tulipa patens* and *Allium* are an important part of its diet from February to April. They found that the stomach contents of several specimens caught near the Dzhebel station consisted of a white mass with a strong onion smell.

In Turkmenia estrus begins in the middle of February. In 1932 the estrus was at its height during the first days of March. Estrus is apparently not affected by bad weather. N.P. Lavrov and S.P. Naumov write: "We rode through the sands of Chil' Mamed Kum from 1 to 6 March. Most of the time there was a snowstorm and the temperature dropped to zero at times. Between the snowstorms, we found fresh tracks in the snow. Following these, we found that some animals had made trips of almost 1 km. Some animals came out of burrows and went along the slope of a sand ridge. Sometimes, they would turn aside and dig in the snow near a bush. We examined such places and always found burrows. The animals would sometimes enter the burrow, but generally they went on to the next burrow after cleaning the entrance. It seemed that these tracks had been
450 made by males in estrus, looking for females. They apparently did not belong to feeding animals. Males caught in this period had much enlarged testes." The estrus lasts several weeks. In the middle of April one finds sterile females, females in estrus, and females in advanced pregnancy. The duration of gestation is not known. Each litter consists of three to six young.

Spermophilopsis molts twice a year. Spring molt starts on the head. The interorbital region and tip of the muzzle molt first. The winter fur is retained longer on the occiput. The fur on the belly becomes thin, but no new fur is observed. The molt then spreads to the shoulders, to the spine, the inner sides of the haunches, the chest and anterior part of the belly. The anterior part of the flanks then begins to molt. At this time the whole body undergoes molt, but the process is slower on the hindquarters. According to N.P. Lavrov and S.P. Naumov (1934), most animals caught in late March in the sands north of Kazandzhik and Kizyl Arvat were molting. Animals caught in early April in the southern part of the Kara-Kum (the Uch-Adzhi station, Repetek) were in full molt. On the other hand, molt is sometimes much delayed. Several specimens in the ZMAN collection caught in late April near Karakul (20-27 April 1930) still had their full winter fur, without any traces of molt. In one specimen caught near Karakul in 24 June 1930, molt was only beginning. Such a delay is abnormal. Most specimens complete their molt in May. Several specimens caught near Ashkhabad and Karakul on 4, 8-9 May 1930 had winter fur on the lower part of the back, near the base of the tail and on the outer sides of the haunches.

According to N.P. Lavrov and S.P. Naumov (1933) the base of the tail molts first and the molt then spreads to the tip. The long hair at the sides of the tail molts in the same sequence. Old hair falls out more rapidly than the new hair grows, and at some stage of the molt there is only a patch of frayed winter hair at the tip of the tail. The new hair grows in the opposite direction, i.e., from the tip to the base.

The skin grows dark during the molt, but the darkening does not reflect the actual process of molt. The skin on chest and belly, which are covered with white hair, keeps its color during the molt, as it does not contain pigment.

N.P. Lavrov and S.P. Naumov did not find different molting dates for males and females.

The molt of the young of the same year into adult fur (which is shorter, coarser and with dark mottling) is completed in the second half of July.
451 Molt begins on the head and ends on the hind legs and buttocks as in adults. This could be determined from the large series in the ZMAN.

The hair on the feet changes so gradually that it is difficult to determine exact data.

Autumn molt begins on the outer side of the tibiae and on the buttocks. It then spreads to the flanks and back towards the head.

The head molts last. The summer fur does not show signs of molt in August. The summer fur of a specimen caught on 2 October 1926 near Saryyazal (along the Kushka railway siding) was very thin on the hind quarters and new winter fur was visible underneath. Specimen No. M.703 of my collection (caught 18 December 1925 near Repetek) has its full winter fur.

Spermophilopsis does not truly hibernate. It remains in its burrow in winter, waiting for the warm weather.

The animals may have several such "sleep periods" during the winter, depending on the weather.

From June to September, many squirrels in the sands near Ashkhabad block the entrances of their burrows with sand from the inside and do not go outside. This aestivation is apparently similar to that of Citellus fulvus. It would be interesting to find out whether Spermophilopsis goes into aestivation throughout its range, and what percentage of the population remains active throughout the summer.

Spermophilopsis is diurnal and is therefore not hunted by nocturnal predators. It is hunted by foxes in some localities. N.P. Lavrov and S.P. Naumov (1933) found many skulls and bones in the Krasnovodsk sands. Hair of Spermophilopsis was repeatedly found in feces of foxes. Spermophilopsis is hunted by the following birds: buzzards, harriers and probably some eagles.

Spermophilopsis causes no harm to agriculture as it lives far from cultivation.

Spermophilopsis causes damage by destroying sand-fixing plants. Seeds of Calligonum and Carex physoides, which are important for this purpose are frequently eaten by it. Near the Dzhebel station N.P. Lavrov and S.P. Naumov repeatedly found seeds of Calligonum which had been sown by the Service of Protective Forests of the Railroad to fix the sand near the railway. They state: "We were surprised how Spermophilopsis succeeded in finding the seeds buried in the sand. Nearly all seeds are destroyed by Spermophilopsis." The animals dig up large areas of fixed sand to obtain the roots and bulbs of plants. Holes made for this purpose are close together. The whole feeding area is covered with holes (12 cm deep and 7-10 cm wide) and with heaps of earth.

D. N. Kashkarov (1932) counted 12,400 such holes per hectare in the Central Kara Kum.

452 The winter fur of the sand marmot is silky and soft. The skin is tough. The pelts may be dyed, and the hair absorbs and retains the dye well. The pelt is of more value than that of Citellus. Commercial use of Spermophilopsis began in 1930, but is still very limited.

The Turkmens capture it with traps. Russians rarely shoot it. Shooting is not a good method as wounded animals often reach their burrows. They have to be shot from a long distance as they are very shy.

Subspecies of Spermophilopsis

376. Spermophilopsis leptodactylus leptodactylus Licht. (1823).

1823. Arctomys leptodactylus Lichtenstein H., Nathurhistor. Anhang zu Eversmann's Reise nach Orenburg und Buchara, S. 119.

1827-1834. Citellus leptodactylus Lichtenstein H., Darstellung neuer Säugethiere, Berl., Taf. XXXII.

1852. Spermophilus leptodactylus Brandt J. F., Zoologischer Anhang zu A. Lehmann's Reise nach Buchara und Samarkand, S. 303.

1882. Spermophilus leptodactylus Bogdanov M. N., Ocherki prirody Khivinskogo oazisa (A Survey of the Nature of the Khiva Oasis), pp. 27-28, fig. on p. 46.

1890. Spermophilus leptodactylus Radde, G. A. Walter and W. Blasius, Die Säugethiere Transcaspiens, Tiflis, 1890, S. 38.

1918. Spermophilus leptodactylus Bil'kevich S. I., Kollektsiya Zakaspiiskogo muzeya (The Collection of the Transcaspian Museum), Izvestiya Zakaspiiskogo muzeya, I, p. 7.

1927. Spermophilopsis leptodactylus leptodactylus Obolenskij S., A Preliminary Review of the Palearctic Sousliks, Compte rendu de l'Académie des Sciences, Leningrad, p. 193.

1929. Spermophilopsis leptodactylus (leptodactylus) (Licht.) subspecies distinguenda Ognev S. I. and V. G. Heptner, Mlekopitayushchie srednego Kopet-daga i prilezhashchei ravniny (Mammals of Central Kopet Dagh and the Adjacent Plain), Trudy Instituta zoologii, 3 (1):131-134.

1933. Spermophilopsis leptodactylus Lavrov N. P. and S. P. Naumov, Rasprostranenie i biologiya tonkopalogo suslika v Turkmenskoi SSR (The Distribution and Biology of Spermophilopsis in Turkmenia), Zoologicheskii zhurnal, 12 (2):80-116; by the same authors: Stroenie mekha i lin'ka tonkopalogo suslika pustyni Kara-Kum (Fur Structure and Molt in Spermophilopsis in the Kara-Kum Desert), Ibid, 13 (2): 311-332. 1934.

TYPE LOCALITY AND DEPOSITION. Vicinity of Kara Ata, 140 km northwest of the Old Town of Bukhara. Holotype probably in the Berlin Museum.

MATERIAL EXAMINED: 151 pelts and skulls.

DIAGNOSIS. Summer fur coarse, stiff and thin. Summer fur on back light, uniformly buff-sand-colored with a rust shade near cinnamon-buff, light pinkish cinnamon (pl. XXIX), sometimes with a yellowish tone (light ochraceous-buff, pl. XV). Summer fur sometimes with a light rust tone and fine gray-chestnut mottling. Winter fur delicate and silky. Color between rich buff-rust-sandy and rust-drab. Fine drab-chestnut mottling poorly developed.

453 MEASUREMENTS: Length of skull 53-58.2 mm (M. 54.5 mm); condylobasal length 47.8-53.5 mm (M. 49.51 mm); zygomatic width 33-36.6 mm (M. (M. 34.42 mm); interorbital space 14.9-18 mm (M. 16.07 mm); length of upper tooth row 9.8-12.2 mm (M. 11.1 mm). Length of body and head 207-305 mm (M. 237 mm); tail without terminal hair 43-102 mm (M. 67.1 mm); hind feet 51-67 mm (M. 57 mm).

SYSTEMATIC NOTES. Even in large series of Spermophilopsis, the characters of the subspecies are difficult or impossible to recognize. This is due to the unevenness of the series and the unavailability of specimens from different seasons. V. G. Heptner and Ognev (1929) suggested that the specimens from the Kara-Kum belong to a separate form which differs from the nominate subspecies in the richer color of the winter fur. The winter fur of this form is ocher, while that of the nominate subspecies is a duller buff-yellow with marked fine mottling. Study of large series did not confirm that these differences are constant. Summer specimens from Ashkhabad, Kerki and Bukhara are also indistinguishable from the nominate form. S. l. schumakovi (from near Kushka) differs clearly from S. l. leptodactylus in its more saturated drab-rust color with fine chestnut-brown mottling (see below). Specimens from the central Kara-Kum (Sernye hillocks) are probably a separate subspecies, as suggested by N. P. Lavrov and S. P. Naumov. The back of these specimens, in winter fur is rust-sandy-golden (cinnamon-buff, pl. XXIX), the flanks are paler (pinkish buff, pl. XXIX) and the belly is white. Lavrov and Naumov did not obtain summer specimens of this race. The status of this form will have to be determined when such specimens are available.

J. Scully (Mammals and Birds Collected in North Afghanistan. Journal of the Asiatic Society of Bengal, Vol. LVI, part II, No. 1, 1887, pp. 70-71) described Spermophilus bactrianus from Afghanistan (Khamiab). As Scully states, this animal is closely related to Spermophilopsis leptodactylus. His detailed description shows that the Afghan squirrel differs from S. l. leptodactylus as follows: 1) 6 teats, (8 in leptodactylus); 2) shorter tail; the tail of bactrianus is shorter than the hind foot; tail of leptodactylus longer (see above). S. bactrianus is probably a different species closely related to the S. leptodactylus.

The geographical distribution has been given above. It should be added that the nominate race occurs throughout the range except in the central Kara-Kum which is inhabited by a pale, as yet undescribed subspecies, and the southeastern corner of its range (the Kushka District) where S. l.
454 schumakovi occurs. It is not known which form occurs in the Semirech'e, from where it was recorded by V. N. Shnitnikov (see above). The Semirech'e squirrel possibly also belongs to a separate race.

376. Spermophilopsis leptodactylus schumakovi Satunin (1908). Kushka, or Shumakov's ground squirrel

1908. Citellus (Spermophilopsis) schumakovi Satunin K. A., Materialy k poznaniyu mlekopitayushchikh Kavkazskogo kraya i Zakaspiiskoi oblasti. VII, Novyi vid suslika iz Zakaspiiskoi oblasti (Material on Caucasian and Transcaspian Mammals. VII. A New Species of Ground Squirrel from Transcaspia), Izvestiya Kavkazskogo muzeya, Vol. III, pp. 254-260.

1918. Citellus schumakovi Bil'kevich S. I., Kollektsii Zakaspiiskogo muzeya (Collections of the Transcaspian Museum), Izvestiya Zakaspiiskogo muzeya, I, p. 7.

1927. Spermophilopsis leptodactylus schumakovi Obolenskii S. I., Rukovodstvo k opredeleniyu suslikov Palearktiki (A Key to Palearctic Ground Squirrels), Izdatel'stvo Oblastnoi stantsii zashchity rastenii, Leningrad, p. 3; Obolenskij S., A preliminary review of the Palearctic ground squirrels, Compte rendu de l'Academie de Sciences de l'U. R. S. S., 1927, 193.

1933. Spermophilopsis leptodactylus schumakovi Vinogradov B. S., Mlekopitayushchie SSSR, Gryzuny (Mammals of the U. S. S. R., Rodents), p. 17.

TYPE LOCALITY AND DEPOSITION. Vicinity of the Kushka fortress, Transcaspia. Holotype in the collection of the Caucasian Museum (formerly the Georgian Museum), No. 70A. a.

MATERIAL EXAMINED: 10 pelts with skulls.

DIAGNOSIS. Differs from typical S. l. leptodactylus in the more saturated gray-rust tone of the summer fur (between pinkish cinnamon and cinnamon-buff, pl. XXIX). Its most typical character is the presence of more intense chestnut-brown bands on the hairs, giving a more chestnut-gray tinge to the fur. These bands are blackish gray on top of the head, giving a darker tone to the head. Dorsal side of tail of S. l. schumakovi darker and more rust-colored than in S. l. leptodactylus.

Dark chestnut-gray mottling of buff-yellow-gray winter fur more marked than in S. l. leptodactylus. The winter fur of S. l. schumakovi is thus darker and duller.

Skull larger. Length of skull 56.3-59.2 mm (M. 58.4 mm); condylobasal length of skull 51.6-54 mm (M. 53.2 mm); zygomatic width 36-38.6 mm (M. 37.6 mm); interorbital width 15.5-20.1 mm (M. 18.2 mm); length of upper tooth row 11.3-12 mm. Length of body and head 237-278 mm; tail 62.2-74 mm; length of hind feet (without claws 56-60.5 mm.

GEOGRAPHICAL DISTRIBUTION. Restricted to the southeastern corner of Turkmenia, the Kushka District.

Subfamily **MARMOTINAE** Chipmunks, Ground Squirrels and Marmots.

Terrestrial mammals living in underground burrows. Only the chipmunks climb on trees although they live in underground burrows.

The fur of the back of marmots, ground squirrels, Citellus fulvus and prairie dogs is of uniform color. In other genera of the subfamily, the 455 fur on the back shows more or less developed speckling or well marked stripes (Callospermophilus, Citellus tridecemlineatus, Eutamias, Tamias).

Tail 1/6 - 1/2 or more of the body length, densely covered with hair of moderate length. The terminal hair of the tail is longest.

Ears very short, forming small folds projecting only a few millimeters. The ears of chipmunks are longer. Forefeet with four toes, hind feet with five. The third toe of the forelegs is longer that the others. The third or the third and fourth toes of the hind legs are longer than the others, both of about the same length.

Claws of ground squirrels and marmots long, less curved than in squirrels. Claws of chipmunks relatively short and curved.

Cheek pouches present.

Molars brachydont, transversely elongate, irregularly rectangular. The tubercles of the molars form transverse, elevated enamel folds.

Formula of molars: $p\,\frac{0.0.0.4}{0.0.0.4}$; $m\,\frac{1.2.3}{1.2.3}$, or $p\,\frac{0.0.3.4}{0.0.0.4}$; $m\,\frac{1.2.3}{1.2.3}$;

Glans penis very narrow terminally, tapering to a slender fingerlike appendage which is slightly inclined downwards.

Os penis of Citellus small and of peculiar form. Baculum with widened, club-shaped base, ending in a flattened, widened, leaf-shaped part or in a plate with a serrated margin. Os penis of Marmota not so widened and with fewer denticles on the terminal plate. The terminal plate of the baculum of the genus Cynomys is even less widened and has fewer denticles.

The geographical distribution and the genera of this subfamily have been given above.

KEY TO GENERA AND SUBGENERA OF THE SUBFAMILY MARMOTINAE IN THE U.S.S.R.

1 (2). Back with five well marked black or dark chestnut stripes beginning at the occiput along the whole back, and alternating with light buff-yellow stripes

Genus **Eutamias** Trouessart.

2 (1). Back without dark stripes, of uniform color or speckled.

3 (4). Size large. Length of body and head of adults not less than 380 mm, length of hind feet without claws more than 70 mm. Pupil round

Genus **Marmota** Frisch.

4 (3). Much smaller animals. Length of body and head usually about 200 mm, to 375 mm in very old, large **Citellus fulvus**. Length of hind feet without claws usually less than 60 mm, reaching 60 mm in old **C. fulvus**. Pupil usually oblong

Genus **Citellus** Oken.

5 (6). Hind soles bare or only margins with narrow fringes of hair

Subgenus **Colobotis** Brandt

6 (5). Hind soles with dense short hair.

7 (8). Nasal processes of premaxillaries narrow in their posterior part, about as wide as one nasal in its posterior third.

Interorbital space narrow, about 1/5 of the condylobasal length

Subgenus **Citellus** Obolenskij (ex Oken)

8 (7). Nasal processes of premaxillaries very wide in their posterior part, about as wide as both nasals in their posterior third.

Interorbital space broad, its width about 23 % of the condylobasal length

Subgenus **Urocitellus** Obolenskij

Genus **Eutamias** Trouessart (1880)

1769. **Sciurus** (partim!) Laxmann M. E., Sibirische Briefe, S. 69-71; Gmelin I. Fr., Caroli Linné Systema Naturae, Tom I, 1788, pp. 150-151.

1826. **Myoxus** (partim.') Siebold Ph. F., De historia naturalis in Japonia statu, etc., Wirgerburgi, p. 17 (**M. lineatus**).

1851. **Tamias**, Simashko Yu., Russkaya fauna tom II, Mlekopitayushchie (Russian Fauna. II, Mammals), p. 601.

1859. **Tamias** Baird S. F., Mammals of North America, Philadelphia, p. 295 (**T. pallasii**).

1880. **Eutamias** Trouessart E. L., Catalogue des Mammifères vivants et fossiles, Fasc. III, p. 29 (**E. asiaticus** Gm.).

1898-1899. **Tamias** Trouessart E. L., Catalogus Mammalium tam viventium quam fossilium, Berolini, p. 429.

1904. **Eutamias** Trouessart E. L., Catalogus Mammalium, Supplementum, p. 330.

Mainly terrestrial rodents which climb well on trees.

The most typical character of the genus is the presence of five well marked, longitudinal, black-chestnut stripes alternating with light yellowish white stripes on the back. Tail without terminal hair 2/3 to 3/4 of the length of the body. Tail about half the length of the body in some American species.

457 Hair of the tail of moderate length. Ventral side of tail without lateral "combing".

Ears of moderate length, about one third longer than wide. Tips of ears without tufts. Cheek pouches developed.

Vibrissae arranged as follows: 1) the longest, thickest and darkest vibrissae between eyes and nose; 2) 3-4 vibrissae above the eyes; 3) small group of 2-3 hairs on the cheeks; 4) on chin and throat; these vibrissae may be absent; 5) on the outer sides of the forelegs, lateral and posterior to the wrist and on the elbow; 6) in the genital area in males.

Teats: p. 1-1; a. 2-2; i. 1-1. Total 8.

Frontal processes of premaxillaries widened. Width of each process in its posterior part equal or almost equal, sometimes markedly wider (in Eutamias speciosus) than width of both nasals in their basal part.

Coronal suture sometimes nearly rectangular. Posterior part of coronal suture sometimes with a sharp lateral projection which points ventrally and slightly laterally.

Interorbital space of moderate width, between 26-28% of condylobasal length. Frontal area slanting and convex. Braincase rounded-oval.

Anterior part of zygomatic arch at level of zygomatic process of maxilla flattened horizontally.

Infraorbital foramina larger than in other genera of Sciuridae, oblong-oval and without angular elevations at base of the infraorbital foramina. Diastema very long, almost twice as long as upper tooth row.

Dental formula; $i\frac{1}{1}$; $c\frac{0}{0}$; $p\frac{2}{1}$; $m\frac{3}{3}$ (=22);

[in the North American genus Tamias: $i\frac{1}{1}$; $c\frac{0}{0}$; $p\frac{1}{1}$; $m\frac{3}{3}$ (=20)].

Type species: Sciurus (Eutamias) sibiricus Laxmann.

GEOGRAPHICAL DISTRIBUTION. Palearctic region from the boreal zone of the Kholmogory forests of the former Arkhangelsk Province to the Bering Sea, reaching the Tundra in the north.

The southern boundary reaches as far as the forests. It turns in a west-east direction, reaching about 48°N in Central Asia. It reaches the Central Asian deserts and includes Manchuria, Korea, Shantung and the central parts of China. In China the chipmunk enters the Oriental Region. Chipmunks also occur on Sakhalin, Iturup and Yezo [Hokkaido].

458 In North America species of the genus Eutamias* mainly occur in the western part of the continent, from the Yukon and British Columbia to Ontario, and as far as Arizona, New Mexico and Texas in the south.

167. Eutamias sibiricus Laxm. (1769). The chipmunk

1769. Sciurus sibiricus Laxmann M. E., Sibirische Briefe, Göttingen-Gotha, S. 69-71.

NAMES: Chipmunk, Pallas' Ground Squirrel, Siberian Ground Squirrel (English); Burunduk, das gestreifte Backenhörnchen (German); le Suisse (French).

LOCAL NAMES: "polosatik" [striped animal] (northeastern Europe); "polozok" [crawler] (Northern Dvina); "zemlyanoi zaichik" [ground hare] (Baraba Steppe); "medvezh'ya sovest'" [bear's conscience] (a jocular name used by Siberian commercial hunters); koch'shar, k'zer or kuozver (along the Sos'va, Mansi and Vogul languages); orda, orda vitsya (the word "vitsya" means stripe, Komi, Zyrian); urdo (Votyak);

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* G. S. Miller records 16 species and 57 subspecies for North America (List of North American Recent Mammals, Washington, 1924, pp. 199-208).

vaarte (Verkhoturye); kustavai (Khanty, Ostyak); kuiarek, yul-ala (Bashkir); kuegeruk (Tatar); kucheger (near the Surgut); sheiek (near the Naryn); koop (near the Ket); denka (near the Yenisei); dzhireki (Mongolian); guriki or girokhi (Buryat); ul'chuki maruvki (Buryat); makhotoi, muruku (Yakut); ulkichan (Manegir and Birar Tunguses); ulchuki or ulchi-oron (on the Sayan Mountains); tar (Nivkhi, Gilyak, western coast of Sakhalin); tagkhr (Nivkhi, inner part and eastern coast of Sakhalin); atakhniki (Ainu); ugukki (Nanai, Orochon); uldshe (Mangun); on'ocho (Kiler near the Kura); iitan (Chukchi); moryumki*, Haopangtza (Chinese).

PRINCIPAL FIGURES: 1) Dvigubskii I., Opyt estestvennoi istorii vsekh zhivotnykh Rossiiskoi imperii (A Natural History of the Animals of the Russian Empire), 1829, pl. 18 (entire animal — poor figure); 2) Simashko Yu., Russkaya fauna (Russian Fauna), Vol. II, 1851, pp. 601-603, pl. 32, figs. 2-3 (in color); 3) Middendorf A. Th., Sibirische Reise, Säugetiere, 1867, S. 83, Taf. II, Fig. 10 (embryo); 4) Fokht K., Mlekopitayushchie (Mammals), Sankt Peterburg, 1885, p. 376, (drawing of entire animal); 5) Brehm's Tierleben, Säugetiere, II, 1914, Taf. S. 516 (in color); 6) Sowerby A. de C., The Naturalist in Manchuria, II-III, 1923, pp. 148-149, Tab. VII, photograph I; 7) Kishida K., An Explanatory Illustration of Japanese Mammals, 1925, 2nd edition (in Japanese), 1926, pl. V (entire animal); 8) Bobrinskii N. A., Opredelitel' okhotnich'ikh i promyslovykh zverei (Key to Game and Commercial Mammals), 1928, p. 48, fig. 32 (entire animal), see also "Opredelitel' okhotnich'ikh i promyslovykh zverei SSSR" (Key to Game and Commercial Mammals of the U. S. S. R.), 3rd edition, 1935, p. 53, fig. 44 (same figure as in the preceding books); 9) Bakutin M. G., Nablyudeniya nad burundukom (Observations on the Chipmunk), Izvestiya sibirskoi kraevoi stantsii zashchity rastenii I, 1930, pp. 69-74, photograph 7 (a hibernating chipmunk), figs. 1-2 (diagrams of burrows); 10) Zverev M., Vrednye gryzuny Sibiri (Harmful Rodents of Siberia), 1930, p. 24, fig. 6 (entire animal); 11) Velizhanin G. A., Zoo-ekologicheskoe obsledovanie khor'kovogo zakaznika Sibirskogo otdelniya instituta zashchity rastenii (A Zoological-Ecological Survey of the Polecat Reserve of the Siberian Institute for Plant Protection), Trudy po zashchit rastenii, 2 (8): 61-62, Novosibirsk, 1931, pl. III (photograph of entire animal), pl. IV (photograph - poorly reproduced); 12) Zverev M. D., Instruktsiya dlya nablyudeniya za burundukom (Instructions on the Control of Chipmunks), Vsesoyuznoi gosudarstvennoe ob'edinenie po bor'be s vreditelyam, 1932, p. 1, fig. (entire animal); 13) Plyater-Plokhotskii K., Vrednye i poleznye zhivotnye v sel'skom khozyaistve DVK (Harmful and Useful Animals for Agriculture of the Far Eastern Territory), Moskva-Khabarovsk, 1934, pp. 40-47, fig. 18, p. 41 (entire animal); 14) Zalesskii I. M. M. D. Zverev, Burunduk (The Chipmunk). —In the Collection published by Vsesoyuznot Kooperativnoe Izdatel'stvo Moskve, 1935, pp. 80-102, fig. 33, p. 81 (entire animal); fig. 34 (map of geographical distribution); fig. 35, p. 86 (hibernating chipmunk); fig. 37, p. 88 (chipmunk on tree); fig. 38, p. 89 (burrows); fig. 39, p. 91 (chipmunk with full cheek pouches).

MATERIAL EXAMINED: 531 specimens (pelts with skulls).

DIAGNOSIS. Slender animal with rounded-oblong head, without a markedly thinner neck.

459 Ears of moderate length, about one third longer than wide. Tip of ears without tufts of hair.

Tail without terminal hair about 2/3 to 3/4 of length of body. Hair of tail moderately long. Ventral side of tail without lateral "combing".

Hind feet relatively long. Short and dense hair covers the soles from the heel to the calluses. Four calluses at the base of the toes. The two lateral calluses are of about equal size, larger than, and posterior to, the inner calluses.

Anterior sole with five calluses. The inner posterior callus is the largest. There is an additional small callus on the innter side of the foot, at the base of the fifth toe.

Vibrissae arranged as follows: 1) the longest, dark vibrissae between eye and nose; 2) 3-4 vibrissae above the eyes; 3) cheeks with a small group of 2-3 vibrissae; 4) on chin and throat; 5) outer sides of forelegs, posteriorly and laterally to the wrist, on the elbow. Vibrissae are also present in the genital region in males.

Teats: p. 1-1; a. 2-2; i. 1-1; total 8.

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* [Obviously an error, since moryumki is not a Chinese name.]

Five longitudinal black-chestnut stripes on the back. The middle stripe begins at the occiput, between the ears. The two stripes next to the middle stripe nearly reach the ears and continue posteriorly, almost to the base of the tail. The dark stripes alternate with light whitish yellow stripes which give an ocher-rust color to the lower part of the back. Belly white.

Frontal processes of premaxillaries widened. Width of each frontal process in its posterior part about equal to width of both nasals in their basal part.

Coronal suture sometimes nearly rectangular. Posterior part of coronal suture sometimes with two sharp lateral processes directed ventrally and laterally. Interorbital width moderate, about 26-28 % of condylobasal length.

Bullae osseae always longer than wide.

The skull of the chipmunk differs from that of most ground squirrels as follows: 1) broader nasal processes of premaxillaries; 2) middle of frontal area not flattened or depressed but convex* and slanting; 3) braincase very elongate, rounded-oval; 4) anterior part of zygomatic arch at level of zygomatic process of maxilla flattened horizontally; 5) diastema very long, almost twice as long as upper tooth row.

The skull of the chipmunk differs from that of the squirrel in some important characters: 1) the interorbital space is much narrower; 2) braincase narrower and more elongate; 3) infraorbital foramina larger, without angular, bony process as the base of the foramina; 4) anterior part of zygomatic arch flattened horizontally (see above), not forming an elevated, anterior plate as in true squirrels.

DESCRIPTION. Rostrum moderately elongate. Zygomatic arches tapering anteriorly, widest in their posterior third. Braincase rounded-oval, moderately broad.

Nasals widened anteriorly and narrower at the base. Frontal processes
461 of premaxillaries markedly widened, but not forming wing-shaped plates obliquely pointing downwards as in squirrels. Posterior part of frontal process as broad as basal part of both nasals.

Zygomatic arches moderately tapering anteriorly, widest in their posterior third.

Postorbital processes thin, sharp, and shorter than in squirrels and ground squirrels.

Posterior part of coronal suture almost rectangular, straight, with sharp lateral processes (Figures 212-215).

Diastema almost twice as long as upper tooth row.

Bullae osseae always longer than broad.

Molars with transverse enamel folds as in squirrels, alternating with grooves, and enamel tubercles at the inner margin of all teeth in form of small, rounded arches.

First upper premolar very small, inclined backwards against the anterior side of the second premolar. Crown of second premolar about five times as large as that of the first premolar. Crown of first premolar trapezoidal, with three transverse enamel ridges. The distal, anterior ridge is poorly developed. The other upper molars have two transverse enamel ridges alternating with three grooves. Two of these grooves lie along the outer margin of the ridges and one of them lies between the ridges. All teeth with well-marked inner enamel arch or crest. These crests form a chain along the inner side of the tooth row.

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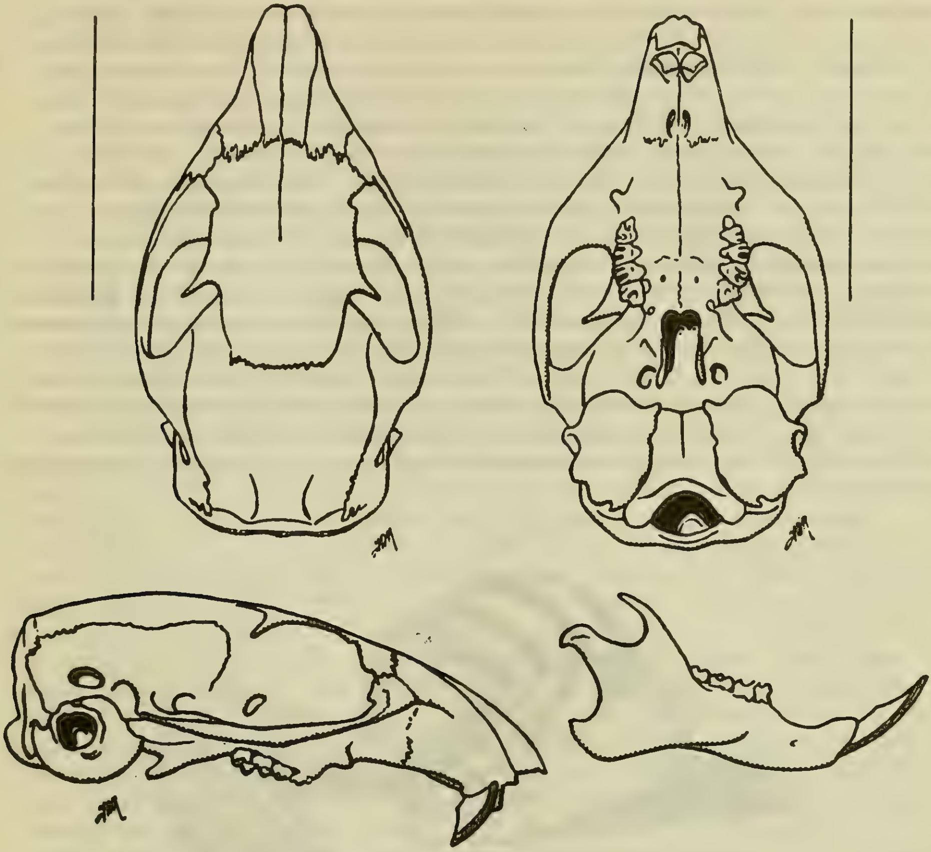
* Such a convexity is present also in the American species Citellus tridecemlineatus.



FIGURES 212-215. Skull of Eutamias sibiricus Laxm., from a specimen from the Minusinsk Territory
Drawing by Yu. A. Kostylev

Each lower molar with two rounded denticles on the outer side of the crown. The anterior denticle is larger than the posterior. Each molar with one high anterior denticle at the inner side of the tooth row, followed by the raised inner margin and the lower posterior, inner marginal denticle. A large depression in the middle of the crown which is particularly large on the last molar. Anterior margin of crowns with a small transverse enamel ridge which connects the outer and inner anterior denticles.

Color. Top of head varying from gray-buff-chestnut to more intense rust-brown with buff mottling in different subspecies. Eye surrounded by a whitish ring. A whitish stripe with a buff tone at the margins from the ring to the nose. Another stripe from the posterior ventral corner of the ring to the base of the ear. A chestnut-black-brown stripe from the posterior margin of the ring to the ear, ending in the middle of the inner side of the ear. A dark-chestnut stripe bordered by chestnut of varying intensity from the anterior part of the muzzle, beneath the ring around the eye, and widening posteriorly. Lower part of cheeks 462 dirty whitish buff. Posterior parts of cheeks sometimes more yellowish rust colored. Occiput behind the ears ash-gray with a rust tinge. Five chestnut-black longitudinal stripes running from the occiput to the middle of the back. Middle stripe from occiput to base of tail. The stripes next to the middle stripe begin on the shoulders and continue to the posterior part of the middle of the back. The lateral stripes begin anterior to the base of the forelegs and continue to the sides of the buttocks. Between the five dark stripes there are four light stripes. The anterior part of the light stripes is whitish buff, and the posterior part more reddish rust colored. The intensity of the rust shade varies in different subspecies between cinnamon-buff and cinnamon, sayal-brown and orange-cinnamon (Ridgway, pl. XXIX). The whole posterior part of the back and the haunches are reddish rust of varying intensity. Yellowish rust tones are also present on the flanks. This color is sharply delimited from the dirty whitish tone of the belly. Tail chestnut-gray. Tips of hair on tail white. Color of hair on tail follows: Roots usually pale buff-rust, followed by broad black bands and white tips. There are also many almost completely black hairs with whitish tips. There are also rust-buff hairs, especially on the ventral side of the tail.

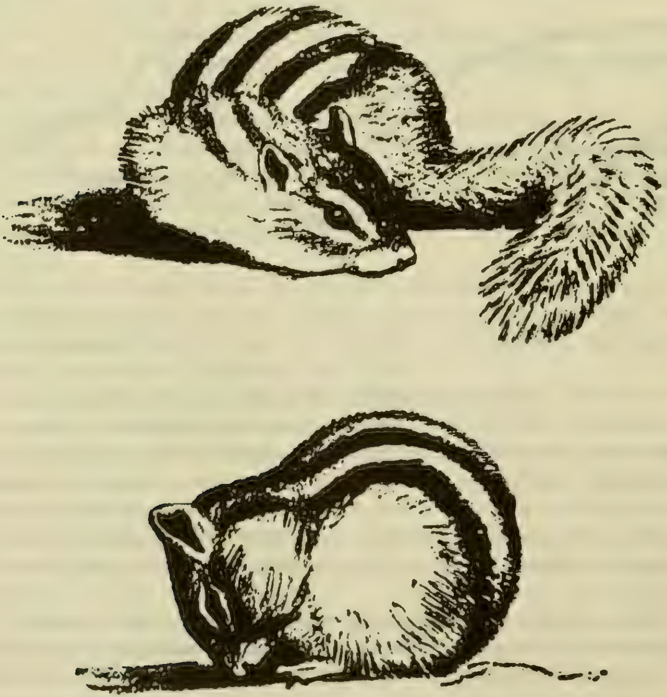


FIGURE 216. A chipmunk

Drawing by A. N. Formozov

Dorsal side of feet gray-chestnut-buff (drab).

Vibrissae gray. Claws dull gray-rust colored.

Color of chipmunks in the middle of summer dull without rich yellowish rust and reddish tones. This results from the loss of the rust-colored hair tips, which causes a grayer and duller tone.

463 The chipmunks molt only once a year. Variations in the texture and color of the fur are caused by wear of the hair tips.

The color of young chipmunks is duller and grayer than that of adults, and their hair cover is thinner, shorter and softer.

SYSTEMATIC NOTES. Nine subspecies of Eu. sibiricus are known at present. Their distribution is shown in Map IX.

GEOGRAPHICAL DISTRIBUTION. (Map IX). The northwestern boundary of the range of the chipmunk runs from Vologda in the north to Kholmogory, reaching the lower reaches of the Mezen river. Chipmunks possibly occur northwest of this boundary as forests of the eastern type with Siberian tree species form an extension northwest of Kargopol. The chipmunk is probably found in the upper reaches of the Onega*.

East of the Mezen the northern boundary of the range runs to the Pechora, in the northern coniferous forests mixed with Siberian trees. In the northern Urals chipmunks have been reported by good authority from about 64° N. Farther east the boundary crosses the southern part of the Ob and touches the West Siberian tundra, entering deep into the forest tundra. Chipmunks are rare near Yanov Stan (66° N) and near Sidorovskaya on the Taz (66°30' N). According to A. Middendorf, they occur in the Turukhansk Territory near Igarka (68° N). In the north Siberian taiga they occur near the southern part of Norilskoe Lake. Farther east, the boundary crosses the middle reaches of the Olenek river and passes to the Lena river (at about 67° N). On the Yana river the boundary turns sharply to 69° N). Farther east it crosses the Indigirka, but the distribution of chipmunks here is incompletely known. It then continues to the estuary of the Kolyma. In the Anadyr Territory chipmunks occur in the valley of the Anadyr river. The boundary then passes to the Apuka river, reaching the Bering Sea and the Olyutorski Gulf. It then turns to Penzhina Bay.

The southern boundary of the range of the chipmunks runs from Vologda through the central part of the former Kostroma Province (Varnavin) to the Kerzhenets river, where chipmunks are rare and to the Vetluga river, where the animal becomes more common (A.N. Formozov, in litt.) I recently received information on the occurrence of chipmunks in the Temnikov District (the northern part of the former Tambov Province). In this region chipmunks are hardly hunted by fur companies, Only three animals were caught in 1934. V.A. Kraft saw one pelt in 1935, but he could not obtain it from the fur company of the town Temnikov. Chipmunks have been found in the vicinity of Sarov, among fallen trees and in groves
464 of European mountain ash near millet fields. This should be further investigated. If it is confirmed that chipmunks occur constantly in this area, the boundary will have to be moved considerably to the southwest.

G.K. Gol'tsmaier (1934) reports that in early summer 1910, P.P. Yal'tsev saw a striped animal which he identified as a chipmunk, in a mixed forest near the village Lutskoe in the Kotelva Subdistrict (Chuvash

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* A. A. Byalynitskii-Birulya recently wrote to A. N. Formozov that he read in a Finnish publication that chipmunks have been found in Finland. This is highly interesting.

ASSR). The forests of the vicinity of Lutskoe are close to the Trans-Sura forest massif on the right bank of the Volga.

If the occurrence of the chipmunk in the Trans-Sura forests is confirmed, the range of the animal in the former Temnikov County is not separated from its main range. All this should be further investigated.

In the Volga region the southern boundary reaches the Kama river, but the animal apparently does not occur on the left bank of this river. Farther east the boundary turns sharply south along the Belaya river. The chipmunk is occasionally common in forests on the right bank of this river. In the southern Urals chipmunks occur to 52°30' N. in the Troitsk District and on the upper reaches of the Ik and Sakmara rivers. The distribution of chipmunks in the Baraba Region is not clear. The animal was not found in forests south of Kokchetav (the Borovskoe forestry). The southern boundary of the range apparently turns sharply north in this area, reaching the Tara. It then passes near Omsk near the steppe. However, chipmunks occur on the islands of Lake Chany. The boundary thus includes the forests of the right bank of the Irtysh which are also inhabited by the flying squirrel and the Teleut squirrel. Farther south chipmunks occur in ribbon pine forests in the Semipalatinsk steppes, e.g., in the Srostki pine forest. To the southeast the boundary continues to Lake Zaisan and to the Mongolian Tarbagatai Mountains (the Malyi Oi Range), including a part of the Greater Altai, the Tannu-Ola Range, Urianghai Territory [Tuvinian ASSR] Höbsögöl Lake, Hentey Range. The boundary then turns sharply north and skirts the steppes of Dauria. It crosses the Argun and runs east through the Hsingan Range and Manchuria. The exact boundary in Manchuria is unknown. I once obtained a specimen from the eastern part of the Kirin Province.

The boundary then passes through northern and central China, not including the Mongolian Desert and the Tibetan highland. It is not known exactly how far south chipmunks occur in China. However they do not occur in the Hunan and Kwangsi provinces, where they are replaced by Tamiops macclellandi*.

Chipmunks are found on Sakhalin, Hokkaido and Iturup islands.

The distribution of the chipmunk in the Vologda Territory is incompletely known. I. F. Brandt (1856) recorded it from the former Vologda Province, where it apparently reaches the Vologda. A specimen from the former
465 Totma County is in the ZMAN collection. Evg. Debyuk (1920) did not find the chipmunk in the Kostroma Territory. However, he mentions geographical names which indicate that the chipmunk was known in this area in the past. For example, Debyuk mentions the Burunduchikha [Chipmunk's] Brook in the Vetluga floodland. According to Zarubin (1856), chipmunks occurred in the former Varnavino County. K. A. Vorob'ev (1927) writes that it is found in the northern part of the former Kostroma Province. B. Bogachev recently found it near the Katromskoe Lake, west of the Vologda and north of the Kostroma. According to S. V. Lobachev (1932), chipmunks are numerous along the Vychegda. According to old data by Georgi they occur along the Northern Dvina, the Vyatka and the Kama. I. F. Brandt (1856) writes that the range of the animal reaches the Mezen.

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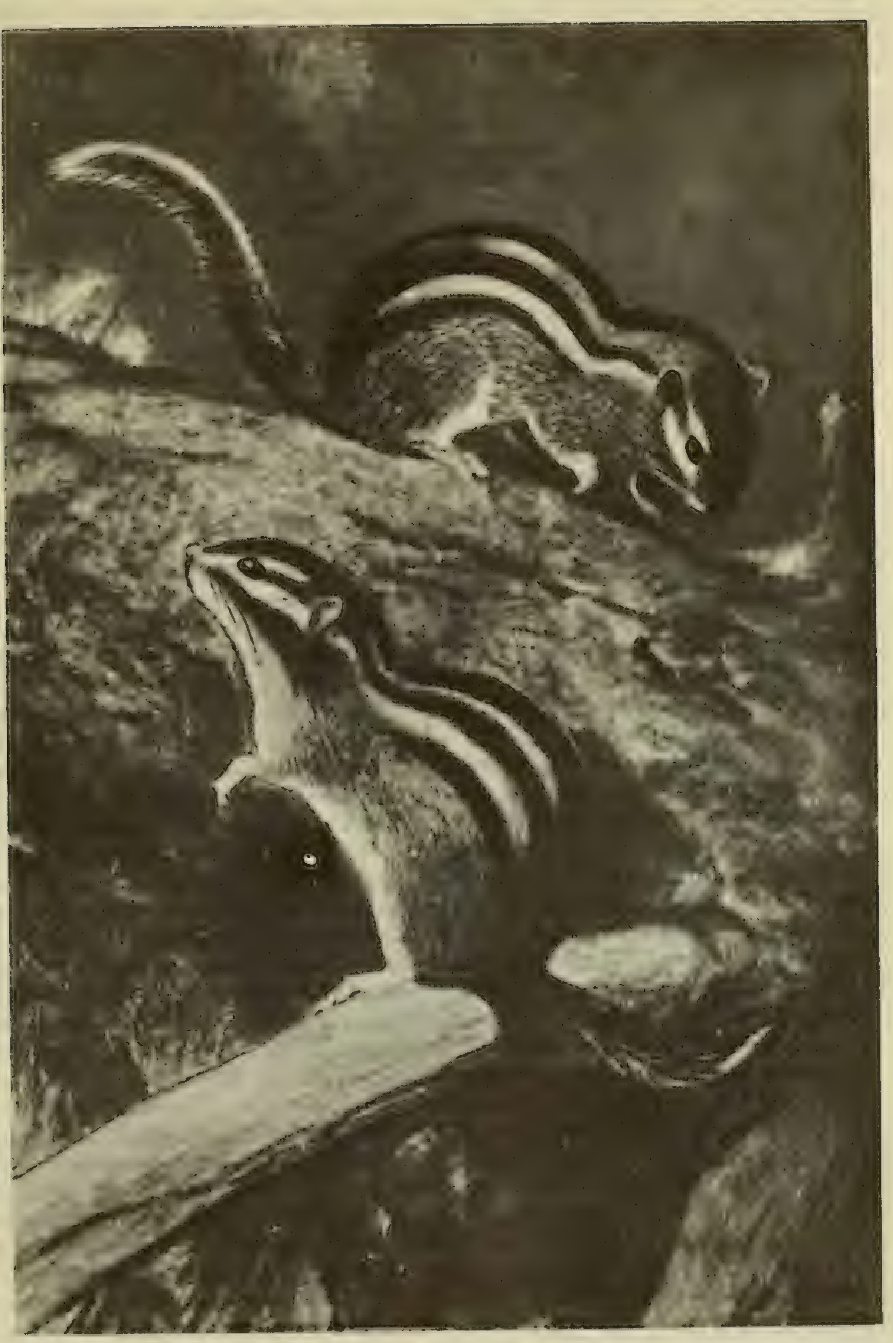
* See McAmicus Shih. Preliminary Report of the Mammals from Jaoshan, Kwangsi collected by the Jaoshan Expedition, Bulletin of the Department of Biology, San Jatsen University, Canton, No. 4, 1930, p. 6. Same author, Note on the Mammals from Southwest Hunan, Loc. cit, No. 9, 1930, p. 3.



Chipmunks. Upper figure — Eutamias orientalis Bonhote. Lower figure — E. s. sibiricus Laxm.
Drawing by V. A. Vatagin

In the Academy of Sciences are specimens caught in the vicinity of Mezen. A specimen was recently caught in this locality by A.M. Sergeev (1935). According to him, chipmunks are rare between Mezen and Kuloi, they apparently do not pass to the western bank of the Kuloi. Chipmunks occur in the basin of Vashka. In my collection is a skin from the Kholmogory District (obtained by V. Ya. Parovshchikov). The chipmunk is certainly widely distributed in the Pechora and Perm Territories. I found it east of the town Cherdyn on the Polyudov Kamen Mountain.

Distribution of the chipmunk in the Gorki Region and in the Tatar Republic. A.N. Formozov provided detailed information on the distribution of the chipmunk in the former Nizhni Novgorod province. It occurs in the northeastern part of this province, along the Vetluga river, and is well known by the local hunters. Chipmunks are much rarer along the Kerzhenets, but they occur on the right bank of this river. The unique discovery of the animal in the Temnikov District of the Mordvinian ASSR has been mentioned above.

The distribution of chipmunks in the Tatar Republic (former Kazan Province) has been described by Prof. M.N. Bogdanov (1871). According to him the animal is common in spruce forests. It is not found on the right bank of the Volga. It is very common in old forests in mountain passes along the Kazanka and Mesha, in the northern parts of the former Kazan and Laishevo Counties. It was also found by Bogdanov along the right bank of the Mesha river, in an oak forest near the village Devlezer'. M.N. Bogdanov (1873) mentions that chipmunks occur in the former Kozmodemyansk and Tsarevokokshaisk [Krasnokokshaisk, or Ioshkar Ola] counties. According to new data by I. Bashkirov and I.D. Grigor'ev (1931), it is found along the right bank of the Kama. However, the animal does not reach the Kama Region in the south (near the western boundary of the Tatar Republic). Large numbers of chipmunks were collected by the staff of the Volga-Kama Commercial Biological Station of the Mozhga District (former Yelabuga and Malmyzh counties of the Vyatka Province). According to A.M. Korsakov (1933), chipmunks are common in the Mozhga District of Udmurt (Votish) Region, in the former Yelabuga County and the southern part of the Malmyzh County (former Vyatka Province). Only small numbers occur in the Mamadysh Canton (former Kazan Province), along the left
466 bank of the Vyatka, in the Lubyany forestry (on the boundary of the former Vyatka Province). Chipmunks are common in the Storozhevsk District of the Komi Region (former Ust-Sysalsk [Syktyvkar] County of the Vologda Province) along the Vishera river, a right tributary of the Vychegda. The chipmunk is very common in the Ugorskii District, in the upper reaches of the Mezen river.

Farther east the chipmunk reaches the right bank of the middle reaches of the Belaya. We found it in this region in the Angasyak forestry of the former Birsk County (Ufa Province) and in large numbers in the deciduous forest near the Dubrovka Village. It was also found in the middle reaches of the Chusovaya river by N.E. Schultz (summer 1936). L.P. Sabaneev (1874) wrote that the chipmunk occurs in the Bogoslovskii [Karpinsk] Urals, in the Pavda woods, where it is more common than in the former Yekaterinburg (Sverdlovsk) County. It is very rare in the southwestern corner of the former Perm Province, and absent in the Shadrinsk steppe. It is common in the former Perm Province. N.M. Dukel'skaya (1928) found it in the Ilmenskii state reserve near Miass.

Prof. Eversmann (1850) found that the chipmunk occurs in forests in the Urals, between the Ik and the Samara. It is particularly numerous near the village Miass. According to N. A. Zarudnyi (1897), it inhabits forests of Orenburg Bashkiria, especially in mixed and conifer forests along the upper reaches of the Ik, Sakmara, Belaya, and between Kaginskii Zavod and Verkhne-Uralsk. The chipmunk is also common near Tastuba (former Ufa Province).

A.I. Argyropulo (1930) writes that the southernmost record of the chipmunk east of the Urals is from near the village Vikilovo, 150 km south of Ishim. To the west the boundary turns to Miass. It was found 80 km south of Zlatoust. In 1926 it was found in birch coppices near the village Novinskoe (Troitsk District) near 52°30' N. This locality and the record of N. A. Zarudnyi at the Sakmara river are the southernmost localities in which the chipmunk occurs in Transural.

K.K. Flerov (1933) states that Eutamias is common in the northern Tobalsk Ural, in the basin of the Sosva and the Lyapin. Chipmunks are found here both in the taiga and in forests on the Urals. They are much rarer in the basin of the Synya.

I. Ya. Slovtsov (1892) writes that chipmunks are common in the Tyumen District of the Tobolsk Territory. They are rarer in the southern part of this district than in its northern part. They are common in the former Turinsk, Tobolsk, Berezovo and Obdorsk [Salekhard] districts. They are rare along the Yurga river of the former Yalutorovsk District and do not occur in the former Ishim and Kurgan districts. The range of the chipmunks reaches the Tara District on the right bank of the Irtysh. According to P. Stepanov (1886), it occurs in the forest-marsh between the Om, Tara and Irtysh rivers along the Tartas, especially along the Tara. Chipmunks have been recorded from the Surgut District, from the taiga near the Barsovaya Mountain (S. M. Chugunov, 1915). The expedition of the Zoological Institute of Moscow University collected many specimens (1932-1933) in the Surgut forests. Farther north chipmunks were observed by K. M. Deryugin in the valley of the Ob river, near the Bolshe-Atlymskie camps and the village Kushevat.

467 The chipmunk is sometimes common in the Tomsk Territory. It was found near Narym (V. P. Anikin, 1902) and is very common along the Chulym river (G. E. Iohansen, 1923). According to B. S. Vinogradov (1924), it occurs in the vicinity of Barnaul and Ust-Kan.

Farther southwest it is found north of Ishim and possibly in forests near Pavlodar and on islands in Lake Chany. Chipmunks in this region occur together with species of the forest fauna (forest mice, etc.) which survived the huge fire which separated Lake Chany from the northern forests. These forests extended almost to Lake Chany in the last century (M. D. Zverev and I. M. Zaleskii, 1935). Chipmunks occur in the Barnaul, Srostki, Kasmalininskii ribbon pine forests, etc. East of the Ob the range of Eutamias includes all forests along the tributaries of this river, the Inya, Berd', Chulysh, etc.).

In the Altai Mountains the chipmunk is common along the Chulyshman, near the Teletskoe Lake, in the Bele area, near Uimon, in the Seminskii mountain pass, in mountains near Lake Tengi, and in the basin of the Biya river, etc. (see N. Kashchenko, 1902). It was found near Lake Zaisan, in forests near the village Maitabai and lake Marka-Kul (G. I. Polyakov, 1914). It occurs in the Sayan highland and Urianghai Territory [Tuva

ASSR] (vide B.S. Vinogradov, 1927). It was observed near Lake Höbsögöl along the Bilutyi, a left tributary of the Hara Gol river, in Mongolia (vide N.F. Kashchenko, 1910). According to M.D. Zverev, the chipmunk occurs rarely in the Kuznetsk Steppe and in the valley of the Inya river to the forested slopes of the Salair Ridge, where it is common. In my collection is a good series from near the village Monok, 150 km southwest of Minusinsk (by N.M. Dukel'skaya). It was recorded by I.N. Shukhov (1925) from the Krasnoyarsk, Achinsk, Minusinsk and Yeniseisk Districts. It is widely distributed in the Khakassian District (M.D. Zverev, 1930). In the Tungus District the chipmunk is very common (N.P. Naumov, 1934). According to S.I. Orlov (1930), it occurs in the Verkhne-Imbatskoye, Turukhansk and Karasino districts. In the basin of the Taz river it enters the forest tundra to 66°30' N, near the Sidorovskaya Pristan [Harbor] (S.P. Naumov, 1931). On the Turukhan it was found up to 66° N near Yanov Stan (S.P. Naumov, 1931). It was recorded by A. Middendorf (1867) from the vicinity of Igarka (68° N). Farther east it occurs along Kureika river, in the region of the Chirinda and Nekonda lakes, along the upper reaches of the Kureika, and near Lake Ochata. The records of E.O. Yakovlev (1930) of the chipmunk along the Medvezh'ya river as far as its lower reaches and along the Ayakli and Kheta rivers to their estuary are incorrect. He informed me that in the forest tundra region east of the Yenisei river only isolated specimens occur at the southern slope of Lake Norilskoe. This is apparently the northernmost record of chipmunks in this part of Siberia.

The chipmunk is not found farther east, along the Kheta and Khatanga.

Chipmunks are numerous in many localities in the Irkutsk Territory. They were observed in the Ust Uda District, in the northern part of the Irkutsk District, along the right bank of the Angara and near the estuary of the Bol'shaya Yanda river (M.G. Bakutin, 1930). They are widely distributed in forests of Transbaikalia, very numerous in the Barguzin forests (G.G. Doppel'maier, 1926). They are common in the Troitskosavsk [Kyakhta] District and occur in eastern Transbaikalia, in the taiga, near the villages Monastyrskoe, Zyul'zikan and Kyker (B.A. Kuznetsov, 1929). Farther south they were found near Urga [Ulan Bator],
468 Uliassutai [Jibhalanta], (Gl. Allen, 1925), Sain Noyan Khan and on the eastern slopes of Great Khingan (a specimen collected by A.S. Lukashkin). Chipmunks are widely distributed in Manchuria (A. Sowerby, 1923), in the Ussuri Territory, Amur Region, on Sakhalin and the Shantar Islands. In Yakutia they are numerous along the Lena and Vilyui rivers (R. Maak, 1859, 1886, and according to recent collections). They occur in the Olekma-Vitim highlands (I. Polyakov, 1873), in the valley of the Yana to its estuary, at 69° N (A. Bunge, 1887). They are found along the Indigirka, the Kolyma to its estuary, the Anadyr and farther south along the Penzhina. They have not been found in Kamchatka.

A. Samorodov recently informed me (in litt., 1936) that the chipmunk is rare near the Olyutorski Gulf, according to Chukchis, Lamuts and Koryaks. The animal is called "pitan" in the Chukchi language.

The chipmunk occurs along the upper reaches of the Apuka and Pakhacha and their tributaries, both in deciduous forests with alder, willow and poplar and more frequently in dwarf cedar forests on mountain slopes. The chipmunk is unknown to the Russian population. A. Samorodov put at my disposal two skins from these areas. They belong to the Yakut race according to their color.

The record of the chipmunk in this region moves the boundary considerably towards the east.

MODE OF LIFE. The habitats of the chipmunk are closely connected with the forest. At the southern boundary of its range it is found in isolated forests near the steppe, e.g., in birch coppices in the Baraba steppe. At the northern boundary of its range it enters the dwarf forest along the tundra, but it is very rare there.

In Bashkiria and the former Birsk County of the Ufa Province I found it in deciduous undergrowth of linden, oak, maple, birch mixed with hazelnut, rowan and European dewberry, on the border of millet fields. It could be found in old windfall at the borders of millet fields. According to unpublished data by S.S. Donaurov and V.P. Teplov ("Material on the Biology and Commercial Exploitation of the Chipmunk" (Materialy po biologii i promyslovomu ispol'zovaniyu burunduka, 1936)), the chipmunk is restricted to fir and larch forests. It is common in spruce-fir forests, but definitely avoids pine forests.

According to I.D. Kiris, chipmunks occur sporadically in West Siberia in the Surgut District in urmans* (cedar forests). In fir groves and spruce forests the chipmunk is much rarer, apparently inhabiting areas near cedar forests, as well as dry ridges. It is even rarer in pine forests. The chipmunk is numerous in birch forests, especially in forests with much old windfall.

According to G.A. Velizhanin (1931), the chipmunk regularly occurs in pine forests of the Baraba steppe, in the Kiprinskii District of the Kamenka Region. Its prefered habitat in this region is shrubs among birch and aspen. It is very fond of European bird cherry in river valleys. Chipmunks occur frequently on low ridges and dry steppe coppices.

469 According to M.G. Bakutin (1930), the favorite habitat of the chipmunks in the Irkutsk District are taiga windfall areas, mountain brooks and plantations of cedar, larch and spruce. The animals are much rarer on mountain ridges than in the foothills. They occur near fields of different crops, in coppices, and among isolated shrubs of European bird cherry. They are apparently attracted to these habitats by the cereal crops. They
470 sometimes occur in small forests and enter valleys with shrubs and trees. Chipmunks are found everywhere in the Irkutsk Territory, changing their habitat according to the food available.

According to B.A. Kuznetsov (1929), chipmunks in Transbaikalia inhabit both coniferous and deciduous forests. Near the village Kyker they occur in the mountain and lowland taiga, most commonly in thickets near streams and brooks. Near the village Zyul'zikan, chipmunks occur in young birch forests along the Zyul'zya and Zyul'zikan rivers. They are especially numerous in birch-grown ravines on the northern slope of the Undin Range.

According to K.A. Plyater-Plokhotskii (1932), the typical habitat of the chipmunk in uninhabited localities in the Maritime Territory is thickets of European bird cherry, currants (Actinidia kolomienta Max.), Amur grape (Vitis amurensis Rupr.) and other trees and shrubs growing at the banks of forest streams and brooks. In large forests chipmunks mainly occur among windfall, and their burrows are under fallen trees. They occasionally settle in screes and in fields among forests. The chipmunks are certainly attracted by plentiful food.

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* [Translator's note: "urmans" — dense, marshy coniferous forests in the taiga].

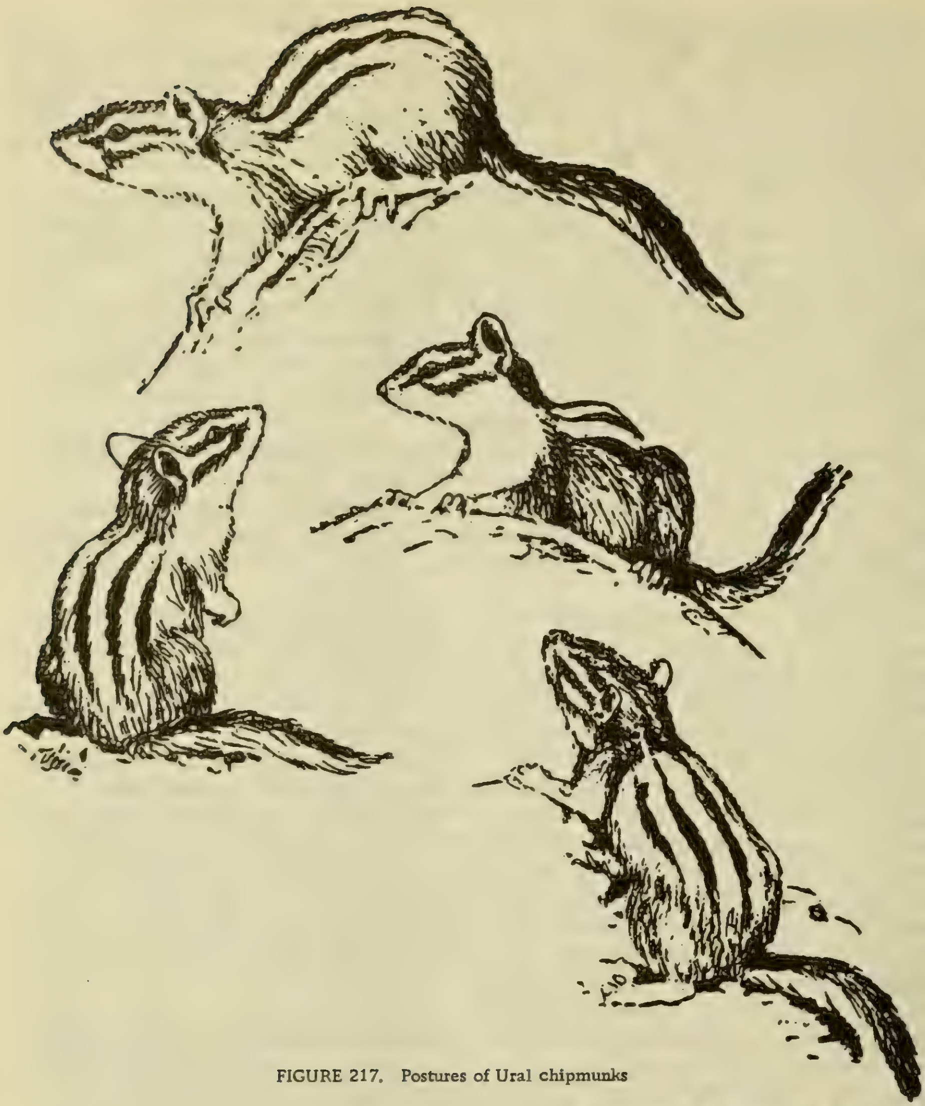

FIGURE 217. Postures of Ural chipmunks

(Sketches from nature by K. K. Flerov)

The chipmunk is an elegant animal. It is timid, but not too cautious, and it is very curious. It runs rapidly, but is more at home among windfall branches. It climbs rapidly on trees, running from one branch to another.

S.S. Donaurov and V.P. Teplov (in litt., 1936) write: "The chipmunk climbs very well with its head up or down. It easily jumps to the lower branches of trees 5-7 m apart and changes direction of its leap in midair with the help of its tail. We know of instances in which chipmunks jumped from the top of spruce trees 30 m high to the ground. They stretched their legs in the air and resembled small flying squirrels. In autumn, in the season of storing food, we saw chipmunks on the thinnest ends of branches of maples, lindens and rowan trees. The animals often held their heads down and clung to the branch with their hind feet only." When man appears, the animal gives a feeble "gurgling" cry, and then loud jerky "chirping"[*]. When the danger is remote (e.g., a man approaches from 471 afar) the chipmunk whistles jerkily and then keeps quiet for a long time. During this silence it rises on its hind legs and carefully contemplates the approaching danger. If one walks quietly and without sudden movements, one may approach the animal to within 15-20 steps. It then rushes away repeatedly giving its whistle. If one hears the whistle of a chipmunk in the forest, it is easy to decide whether it is sitting quietly in one place or running away. Frightened chipmunks do not always run to their burrow. They usually hide in windfall or brushwood, or run on the branches of a tree to hide among the dense foliage.

The chipmunk is a diurnal animal. In Bashkiria I saw it most frequently in the morning when it became warm and in the evening, before sunset. The same was observed by B.A. Kuznetsov (1929) in Transbaikalia. K.A. Plyater-Plokhotskii (1932) gives the following description of the daily life of chipmunks in the Maritime Territory: "The daily life of the chipmunks varies according to the season. In spring they come out of the burrow only when the sun has warmed the ground sufficiently. Their main activity lasts from 10 a.m. to 3.30-4 p.m., i.e., the hottest hours of the day. No chipmunks remain outside by sunset. They also remain in their burrows in windy and rainy weather.

"In summer they come out before daybreak as soon as the first signs of light appear. They then jump from one branch to another, sit on their hind legs and wash themselves with their forefeet, descend along branches and upturned trees to a river or stream to drink and feed. Between 12-2 p.m. the animals disappear and their whistling is not heard. They take shelter in the burrows during the hot hours, come out again when the heat subsides, and turn in at sunset. In the dense, shady and cool Ussuri taiga the chipmunks are active throughout the day, without an interval at noon.

"In autumn and on overcast days in summer chipmunks stay outside from sunrise to sunset. Rainy weather usually keeps them in their burrows, but in the Ussuri Territory they are seen even during rain. This may be due to the great number of rainy days. The sounds made by them before rain differ sharply from their ordinary whistling. This is so well known in the Ussuri Territory that 'root hunters' (collecting ginseng roots) predict rain from these sounds."

Burrows and nests. The chipmunks build their burrows between roots of trees, under pieces of rock or similar shelters. All burrows found by S.S. Donaurov and V.P. Teplov (in litt., 1936) in the Volga-Kama Territory were on dry hillocks. The entrance to the burrows was usually at the base of tree stumps or near small mounds. The burrow usually descends at an angle of 45° immediately after the entrance. It then continues horizontally and ends in a round chamber which contains the nest.

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[*] Chipmunks make their peculiar "gurgling" sounds warning others of danger already during their first months of life. S.S. Donaurov and V.P. Teplov (in litt., 1936) studied the daily life of young (2-2.5-month-old) chipmunks in open-air cages in the forest. They repeatedly observed that the chipmunks have a peculiar system of signals. All five specimens in the cage were usually active for many hours after feeding, climbing on trees and running among fallen branches in the cage. However, as soon as one of the chipmunks saw a large bird, even at a distance, or a passing man, it emitted a quiet "gurgling". Then, all chipmunks stopped and remained motionless for two to three minutes.

472 Side galleries are rare and there are never more than three. The burrows usually have one exit. The galleries are 60-400 cm long, and the chamber is 20-35 cm wide and 40-95 cm underground. Some burrows have small corridors filled with excrement. Food reserves are kept in chambers, rarely in side galleries. The nest is also in a chamber and it consists of dry leaves of linden, maple, fern, raspberry and aspen. Some nests are made of moss (Hypnum) and scales of pine bark. The nest is round and fills the whole space of the chamber in which there are no food reserves.

M. G. Bakutin (1930) gives the following description of chipmunk burrows in the former Irkutsk District: "There is usually one exit which is covered by vegetation. From the exit runs a gallery, 5-6 cm wide. At a distance of 40-50 cm from the entrance is a round depression not wider than 30-35 cm, which is the storeroom. This is connected by a straight, 40-cm-long gallery to a similar depression which contains the nest."

M. G. Bakutin observed one or two blind side galleries from the main gallery on the same level. They were 20-30 cm long and were full of excrement.

According to Bakutin, the nest itself is lined with leaves of birch, aspen and grass. In burrows in fields the nest is lined with broken stalks of rye and wheat, and empty ears of cereals.

B. A. Kuznetsov (1929) gives the following description of summer burrows of chipmunks: "The structure of winter burrows differs from that of summer burrows which are very simple. They begin with a round opening, 4-5 cm wide. The main gallery descends into the ground and ends in a round chamber usually without any padding. The burrow is 50-75 cm long. The beginning of the main gallery sometimes has a small side gallery."

K. A. Plyater-Plokhotskii (1932) gives a similar description: "The chipmunks usually dig their burrows among roots or under fallen trees. Sometimes there are whole chipmunk "towns" in screes. Some burrows begin in a rotten tree stump and continue deep under ground. It is difficult to find burrows, as they are usually concealed by overhanging stones, or roots, or are in the middle of vegetation. Burrows are rarely made in hollows of live trees, but sometimes in those of fallen trees. The entrance of the burrow is round or oval, not much more than 4 cm wide. The first part of the burrow descends from the opening at an angle of 45° to 70°. After two or three bends the burrow ends in the nest chamber. Two or three side galleries branch from the main gallery. Some of them contain only excrement. Others are widened at the end into large storerooms. Usually there are no other side galleries between those ending in storerooms and the nest chamber. The main gallery is sometimes widened into a storeroom
473 before the nest chamber, and then narrows again until it reaches the nest. In this case there is only one side gallery which serves as a latrine. On plots among isolated trees and shrubs there are burrows which are apparently temporary. They are usually 60-70 cm below the ground, short and without storerooms. The main gallery bends once or twice and ends in a nest chamber. We found some permanent burrows with two storerooms.

"The depth and length of the burrow depend on the soil. Burrows in sand usually have a gradual slope, are 70-80 cm deep and 2.5-3 m long. Burrows in loamy soil have a steeper slope (70°), and are 1.5 m deep and 2-2.5 m long."

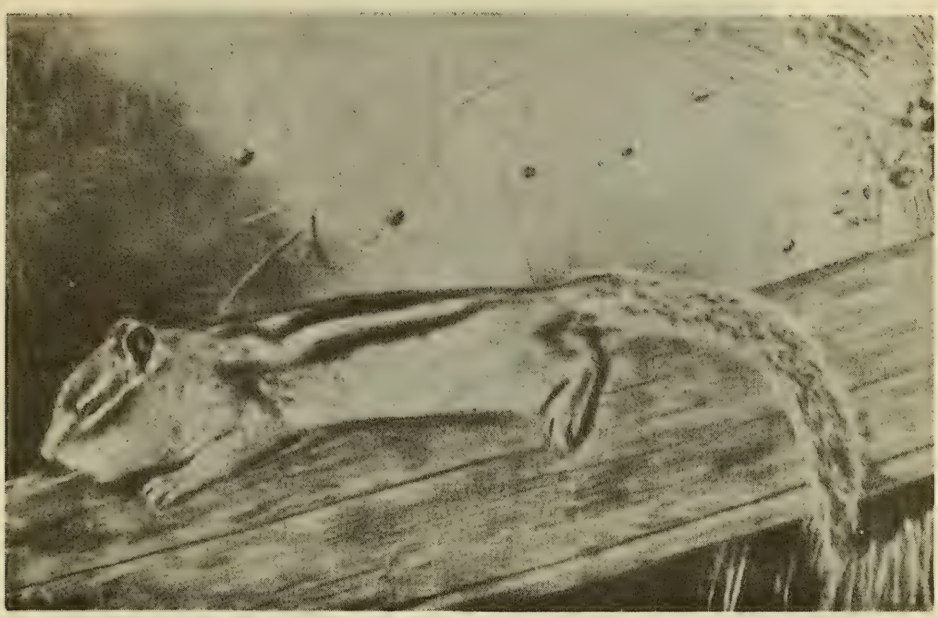

FIGURE 218. Chipmunk caught in the valley of the Belaya in Bashkiria. The cheek pouches are filled

Food. The chipmunk is mainly vegetarian. Animal food is a less important part of its diet. The main information on this subject is given by S.S. Donaurov and V.P. Teplov (1936) who studied the food of chipmunks in the Mozhginsk District of the Votish Region (former Yelabuga County and southern part of the Malmyzh County, former Vyatka Province).

They examined the content of the cheek pouches of 324 specimens caught in the field. The food consisted of vegetable matter, in 97.8% and of animal matter in 30.9%.

Only 0.3% of the vegetable food consisted of seeds of cultivated plants. 474 This is strange because the cheek pouches of specimens caught in autumn near the Belaya river (former Birsk County) were stuffed with millet seeds.

According to S.S. Donaurov and V.P. Teplov, wild plants eaten by the chipmunk belong to two groups. The first group includes the following trees and shrubs: rowan, elm, smooth-leaved elm, hazel, maple, linden, European bird cherry, raspberry and honeysuckle. The seeds of these plants are found constantly in the food stores of the chipmunk. The second group consists of seasonal plants, berries or seeds of forest plants: strawberry, bilberry, Paris, bramble, sedge, asarum, Oxalis, Melica nutans, tall buttercup (Ranunculus acris), crowberry, aconite and spindle tree.

Mushrooms are not eaten by chipmunks.

The main animal foods of the chipmunk are invertebrates (30.3%). Vertebrates constitute only 1.5%. In two cases remains of the bank vole (Evotomys glareolus) were found in its stomach. Remains of Lacerta agilis were found twice, and those of a small bird, apparently a nestling of Fringillidae were found once. The chipmunk rarely eats eggs of birds, e.g., of thrushes.

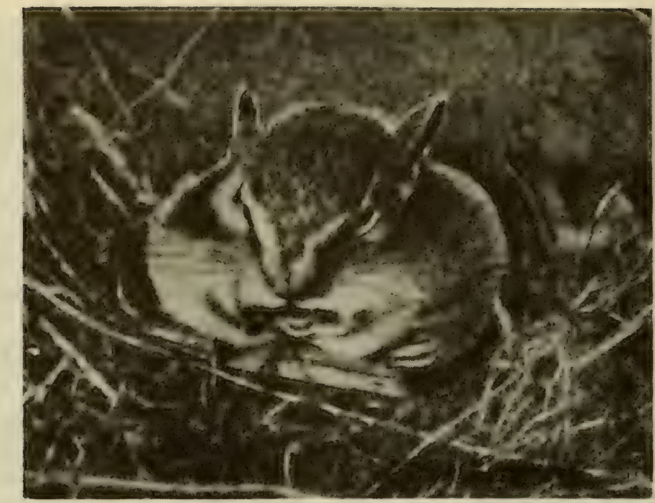

FIGURE 219. Head of Bashkirian chipmunk, cheek pouches filled with millet.

The most common invertebrate remains are those of insects (18.2%), followed by those of snails (12%). Helix and slugs (Arion) are also eaten. Of insects, mostly ants are eaten.

S.S. Donaurov and V.P. Teplov estimated the weight of the average daily food intake. They found that the animal consumes 7.5 to 15 g of seeds and 55-94 g of berries.

According to M.G. Bakutin (1930) chipmunks in the Irkutsk District feed on cedar nuts soon after coming out of hibernation. In the middle of June this author caught several chipmunks with cheek pouches filled with seeds of Geranium pseudosibiricum, wild rose and seeds of sedge, crowfoot, etc. Seeds of Carex pediformis were commonly found 475
in cheek pouches. This is due to the fact that this plant grows on slopes in thin forests, windfall, etc. The favorite grains are wheat and rye. Oats and hemp are taken less readily by the chipmunk.

In Transbaikalia B.A. Kuznetsov (1929) found larch seeds and seeds of various forest herbs in the cheek pouches. He rarely found remnants of insects, usually of beetles.

In autumn chipmunks are found in large numbers near fields at the edge of the forest, because of the ripening grain crops.

According to I.M. Zalesskii and M.D. Zverev (1935), chipmunks feed on buds of birch, larch and other trees in spring. When the snow melts, they begin feeding on old cedar cones, young shoots of grass and seeds of forest sedge. The diet becomes more varied in summer and the animal eats rowan berries, cranberries, red bilberries, European bird cherries and raspberries. When mushrooms grow, the chipmunk, like the squirrel, fixes them on branches, The chipmunk is fond of seeds of wild forest grass, Umbelliferae, seeds of sedge, wild millet, species of Polygonum, crowfoot, Thymus serpyllum, tufted vetch, etc. In Siberia, pine nuts are the favorite food of the chipmunk in autumn. In the Far East the animal is fond of pine nuts, acorns and linden seeds. According to K.A. Plyater-Plokhotskii (1932), the chipmunk eats the following cultivated plants: wheat, rye, barley, buckwheat, oats, corn, flax, millet, sunflower, cucumber, squash and eggplant, watermelons, melons and gourds. In orchards it destroys plums, cherries, apricots, pears and apples.

European chipmunks occasionally eat animal food. They eat insects and their larvae, they may attack frogs (according to Korsh) and even lizards (according to observations of A.M. Nikol'skii on Sakhalin).

In late July or early August, according to the locality the chipmunks begin to collect stores for the winter. The food is carried into the burrow in the cheek pouches. The rodent bites off a stalk, holds it between its forefeet, rapidly extracts the seeds and puts them into the cheek pouches. As the cheek pouches become stuffed, the whole head becomes round and large (Figures 218-219).

The chipmunk stores in its burrow various plants in the area. According to S.S. Donaurov and V.P. Teplov (in litt., 1936), food reserves of the chipmunk include seeds of the following plants: 1) maple; 2) linden; 3) rowan tree; 4) hazelnut; 5) European bird cherry; 6) raspberry; 7) elm; 8) Ulmus scabra. Some chipmunks also store seeds of sedge, Actaea, and honeysuckle.

According to Donaurov and Teplov, the stores are small, at most 1,480 g. In the Siberian taiga the chipmunks hoard pine nuts, seeds of larch and grass, as well as buds of trees (e.g., birch buds). K.A. Plyater-
476 Plokhotskii (1932) observed in the Far East that burrows rarely contain food reserves of one chipmunk. The burrows usually contain a large variety of food. He found corn, wheat, barley, buckwheat, sunflower seeds, hazelnuts, acorns and dry mushrooms. Each kind of food was stored separately.

The size of the food reserves varies. K.A. Plyater-Plokhotskii writes: "The largest food reserve weighed 6 kg and consisted of 3,650 g hazelnuts, 1.5 kg of wheat, several sunflower seeds, acorns, dried crab apples and corn seeds.

"Reserves of 1.5-2 kg are common. In some villages of the former Amur District peasant children dig up chipmunk burrows to get the nuts. In fairs, nuts collected by chipmunks are more expensive than those collected by man, as chipmunks never collect spoiled nuts." M.G. Bakutin (1930) excavated chipmunk burrows and found up to 1 kg of rye and wheat.

The observations of K.A. Plyater-Plokhotskii prove that the chipmunks make long trips to collect food, sometimes a kilometer or more from the burrow.

In one burrow K.A. Plyater-Plokhotskii (1932) found 1 kg of rye, 500 g of buckwheat, 500 g of corn and some sunflower seeds. The nearest cornfields were more than 1 km from the burrow.

REPRODUCTION. According to I.M. Zalesskii and M.D. Zverev (1935) chipmunks breed once a year, and a litter consists of 4 or 5 young. The young are born naked and blind. According to S.S. Donaurov and V.P. Teplov (1936), gestation in the Volga-Kama Territory lasts 35-40 days. There are 3 to 10 embryos (5.57 on the average). Unfavorable years cause mortality of embryos through resorption. This was also established for squirrels and ground squirrels. Only indirect data were obtained for chipmunks. A marked retardation of growth of some embryos was observed. The reproduction rate of chipmunks fluctuates widely, due to variations in the number of embryos. Sterile females are rare.

S.S. Donaurov and V.P. Teplov (in litt., 1936), studied the sexual life of chipmunks. They found that burrows are occupied by hibernating couples in autumn. In the Volga-Kama Territory chipmunks mate in late April. They possibly mate before coming out of the burrows. The mating period ends in early May. The authors state that the chipmunks do not 477 show great excitement during copulation, and males do not chase each other or fight. According to Donaurov and Teplov the suckling period lasts 28 to 30 days, and there is only one litter in spring. After coming out of the burrows the young grow rapidly and reach their full size by the end of July. Maturity is reached during the first year, in about the eleventh month.

G.A. Velizhanin (1931) gives a description of life in spring and mating of Eutamias in West Siberia. The animals come out of hibernation on the 1st of April. For several days they show little activity, climb trees and sit there for hours, basking in the sun. Several days later, with the beginning of spring, they become much more active. One frequently hears their cries at this time and sees males fight and chase the females. Copulation usually takes place on a tree. Afterwards the animals remain motionless for 30 to 60 minutes, only making writhing movements with their tails. The young appear in West Siberia in May, and in July they are already independent.

According to M.G. Bakutin (1930), estrus begins in late April in the Irkutsk Territory. The young are born in late May or early June. They are suckled during June. In early July they come out of the burrows and feed on red currants and seeds of sedge (Carex pediformis). Young born near fields feed on rye and wheat seeds. The female guards the young during the first days; at the sight of danger she emits a peculiar chirping cry which is answered from all sides by the young rushing to hide. Bakutin thinks that chipmunks have only one litter per year.

According to K.A. Plyater-Plokhotskii (1932) chipmunks have estrus in late April and early May. During estrus the males fight and chase each other, emitting shrill whistles. The young of chipmunks in the Maritime Territory are born in late May or early June, a litter consisting of 4 to 6 young (10 to 12, according to some information). K.A. Plyater-Plokhotskii observed only one litter in spring. According to information from local people, the chipmunk has 2 or 3 litters a year, but this seems doubtful. G. Radde (1862-1863) writes that there are two litters, in May and August. B.A. Kuznetsov (1929) states that his observations confirm Radde's statement, but he does not explain this. B.S. Vinogradov and S.I. Obolenskii (1927) also write that there are two litters, in June and August.

478 To judge from our data and from observations on ground squirrels, the chipmunks have only one litter in spring.*

Sex ratio. S.S. Donaurov and V.P. Teplov (1936) studied a large amount of material. They found that there are more males than females, i.e., 60% males to 40% females. Males predominate among the newborn, constituting 80%. Natural mortality gradually levels this off. Most of the young hibernate in couples. Most of the single males die because they remain active in the bare forest.

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* A.N. Formozov informed me that he heard cries of females in the Ussuri Territory in late June, the same as those made by rutting animals in spring. In A.N. Formozov's opinion, the chipmunks have estrus only once, and the sounds mentioned may only be manifestations of a "false estrus".

MOLT. Chipmunks molt apparently only once a year. The molt begins in June and ends between July and the middle of September. The molt apparently takes place in the following order. Molt begins in the middle of the back, where the skin shows an irregular dark patch. Darkly pigmented stripes often appear exactly beneath the dark stripes of the fur. In some specimens molt begins in the lower posterior part of the back like in squirrels in autumn. Sometimes the whole back molts at the same time.

According to S.S. Donaurov and V.P. Teplov (in litt., 1936), adult males in the Volga-Kama Territory begin molting at the end of the breeding period, i.e., in the last ten days of April. The most intensive molt is observed between the end of May to the end of June. Some males which had not yet begun molting were caught in the middle and end of May. A specimen in the initial stage of molt was collected in the first days of August.

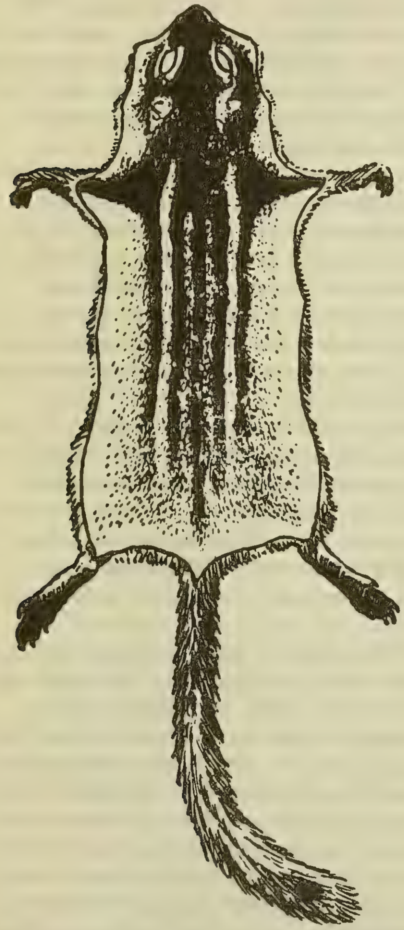

FIGURE 220. The inside of the skin of a molting chipmunk from Surgut (old female, 23 July 1932)

Drawing by A.N. Formozov

Molt may last 50 days in adult males.

479 The females begin molting almost at the same time as the males, i.e., in the last days of April. Some specimens begin molting in early May. Molt is slow and becomes more intense only after lactation (from the beginning of July). Females finish their molt early in August. Molt thus lasts 90 days.

The young begin molting before coming out of the burrows. Molt in most intensive in the last days of July and ends in the middle of August. Skins with signs of molt are found until the end of September. In Siberia the beginning of molt is much delayed in females, and ends in late September. Young molting specimens are found until September-October.

MIGRATIONS. The chipmunks may make long migrations, usually in search of better food. Hunters report that chipmunks may be observed in late April migrating over the frozen snow from the taiga to the forest bordering cultivated areas.

M.G. Bakutin (1930) describes migrations in the forests of the Irkutsk Territory: "From early to middle June chipmunks lived on slopes of mountains near the Bolshoi Tangat river. In the second half of June the chipmunks began to leave these places to reach the forested valleys and feed on red currants. They remained there until the middle of

August and then returned to their original habitat, except for a few which apparently had decided to remain in the forested valleys during the winter. They collect food, e.g., berries of red and black currant and seeds of grasses.

"In 1925 migration of the chipmunks was large-scale and caused great damage. The animals left the taiga, migrated to the fields and destroyed the crops. Wheat and rye were severely damaged, oats and hemp less. This migration was apparently caused by a severe failure of the crop of pine nuts."

K.A. Plyater-Plokhotskii describes a migration of chipmunks: "In August 1927 there was a great flood in the Maritime Territory. Small forests near cultivated land in the valley of the Iman were invaded by large numbers of chipmunks in the first days of August. All chipmunks disappeared suddenly, and moved to the mountains. On 12 August, the valley was flooded. If the chipmunks had not left at this time, most of them would have been drowned. The same valley was inhabited by large numbers of other small rodents. When the river overflowed and carried away the sheaves of wheat, many of these were literally covered with field mice, rats and meadow mice, but no chipmunks were among them."

HIBERNATION. In West Siberia and the northern part of the European U.S.S.R. chipmunks hibernate from late September to early October. East European chipmunks apparently hibernate at the same time. K.A. Plyater-Plokhotskii (1932) writes on the hibernation of chipmunks in the Far East: "From the beginning of October, chipmunks become less common. In the middle of the month they go into hibernation. In the southern part of the Maritime Territory chipmunks may sometimes begin
480 to hibernate only in November. In mild, warm winters chipmunks may be found outside their burrows, even in December."

S.S. Donaurov and V.P. Teplov (in litt., 1936) observed in the Volga-Kama Territory that burrows are occupied by couples in autumn (see above). In their opinion, chipmunks are monogamous, and the male apparently leaves the female only during suckling, rejoining her afterwards. These habits, especially the hibernation of couples, should be further studied.

DAMAGE. The chipmunk may cause great damage to grain crops, especially in years with crop failures of cedar nuts or other food plants of the taiga.

I.M. Zalesskii and M.D. Zverev (1935) write: "The chipmunks settle near the fields and begin their harmful activity immediately after sowing. The animals dig out the seeds at the edge of the field, and occasionally cause great damage. When the grain begins to grow the animal bites off the young stalks. However, the greatest harm is caused when the grain ripens and the animal begins to store food for the winter. It spends all day travelling from the burrow to the field and back. It comes out of the forest early in the morning. If there is no danger, it runs to the wheat fields where it may hide from enemies. It leaves spoiled or small ears intact. If it finds a good, full ear, it climbs the stem, takes it between its teeth and bends it to the ground. It cuts the stalk near the ear, takes this into its paws and picks out the grain which it stuffs into its cheek pouches. It then runs to the burrow and puts the grain into the storeroom.

The chipmunk is intelligent. When the crop is very dense and it cannot bend the stalks to the ground, it adopts a different method; it cuts the stalk into parts until it reaches the ear. It may sometimes cover 1 km or more from the burrow to the field. The cheek pouches usually contain only 8-9 grains. It has thus to run repeatedly to the field in order to obtain sufficient grain for its stores."

Millet fields were severely damaged in the middle reaches of the Belaya in Bashkiria (former Birsk County of the Ufa Province). The cheek pouches of specimens caught were stuffed with millet grains.

The Birobidzhan District (Far Eastern Territory) suffered an invasion of chipmunks in autumn 1926, in which 70-80%, sometimes 100%, of the crops were destroyed. The animals settled in the fields in stacks of wheat. K. A. Plyater-Plokhotskii (1932) reports that a blow with a stick drove 10-15 chipmunks out of the shocks. In 1927 a mass invasion of fields on the border of the forest in the Iman District, Far Eastern Territory, forced 481 the peasants to abandon their fields. In 1925 there was a mass migration of chipmunks from the mountain taiga of the Ust Uda District (Far Eastern Territory) to the grain crops in the valleys. Wheat and rye fields suffered most, oat fields and hemp plantations less.

I. M. Zalesskii and M. D. Zverev (1935) write: "In central and western Siberia chipmunks cause damage, though not very severe. Damage to grain crops was caused in the Narym Territory, the northern part of the Baraba Steppe, the northern part of the Tara District, the Achinsk District and adjacent districts, and to some extent in the Minusinsk Territory. Concentrations of chipmunks were observed in birch coppices near oat fields. Their burrows were found to contain grain stores, mainly oats but also wheat and rye. In some places stalks of oats were cut 1 1/2 vershok* above ground, and the grain had been taken. In another place, oat fields on the border of the taiga were severely damaged... Chipmunks were also found to cause great damage to shocks of rye, and their food stores contained seeds of hemp and flax."

Chipmunks also damage gardens and orchards. Cucumbers, eggplants, marrows, corn, poppy, peas, beets, carrots and potatoes suffer from the raids of chipmunks. The last three vegetables are readily eaten by chipmunks in captivity. Chipmunks climb the stalks of sunflowers and pick out the seeds, fill their cheek pouches and carry them to the nest. They also damage melons, gourds and watermelons. They have been reported to have damaged cherries, apples and pears.

Methods of control are little developed. Chemical methods may be used, whereby sheaves of wheat are treated with natrium arsenite. K. A. Plyater-Plokhotskii (1932) reports that peasants control chipmunks by placing cats into their habitats, especially into those of gravid females. Kittens born in the forest quickly learn to hunt chipmunks and kill large numbers, but this method gives only temporary results.

ENEMIES. According to S. S. Donaurov and V. P. Teplov (in litt., 1936), buzzards and sparrow hawks are enemies of the chipmunk in the Volga-Kama Territory. The chipmunk is an important part of the diet of the buzzard during the breeding period, and 30% of its food consists of chipmunks. The following mammals hunt the chipmunk: hamster, weasel, ermine, marten fox, wolf, rat, polecat and badger. The black hamster which is widely distributed in forests of the Gorki Region and Bashkiria is a great enemy of the chipmunk. It not only robs the stores of the chipmunk, but also eats the chipmunk if it does not succeed in hiding.

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* [Vershok — 4.445 cm.]

According to M.G. Bakutin, who studied the chipmunk of the Irkutsk
482 Territory, its main enemies are the ermine, the ferret and the bear. During the autumn hunt of ermine and Siberian ferret, hunters often find them in the burrows of chipmunks which have often already been eaten. Where chipmunks are numerous bears hunt them and excavate their burrows. The bear eats the food stores of the chipmunk, and also eats the chipmunk. In the Far East the chipmunk is also hunted by weasels, raccoon dogs, foxes, wolves, and occasionally by snakes (Elaphe schrenckii). It is also hunted by birds of prey like the goshawk.

COMMERCIAL VALUE AND TRADE. Chipmunk pelts have only recently appeared on the fur market. It has a beautiful pelt which can be used for fur coats.

The chipmunk is caught by three main methods: 1) by shooting with the help of dogs (especially eskimo dogs), 2) with decoys; 3) with traps.

V. V. Gubar' (1930) describes hunting with a lure in the Upper Ob forest (former Biisk County). "Chipmunks are hunted with decoys in April. In clear weather the hunter takes a special whistle and a long rod with a loop of horse hair. He settles in a glade and, with the whistle made of a cartridge, makes sounds imitating those of a rutting female.

"The cry of the rutting female is a characteristic sound quite different from the ordinary 'chirping.'*

"All males in the vicinity are attracted by this mating call and run towards the hunter, ignoring even cold water. The excited males swim across streams of icy water and even in the presence of man continue trying to find the female. The male waves its tail, chirps, jumps on trees and into the grass, approaching the waiting hunter.

"The animal approaches to within two or three steps from the source of the call. It pauses and sits on its hind legs. At this moment the hunter slips the loop over the head of the animal, pulls the rod and the chipmunk is captured."

483 Hunters may catch 30-40, and even 100 specimens in a day, by this method.

The Yenisei Tunguses and the Ob Ostyaks and Shorians use bows. The metal arrowheads are replaced by blunt heads, because sharp arrowheads spoil the fur. The bow is large, as tall as a man, and the string is made of a strong, twined packthread. The hunters shoot with great accuracy; the blunt arrow, if shot from a short distance stuns the animal, or kills it. Dogs are necessary in this primitive hunting, to drive the animals on to the trees.

West Siberian hunters have recently introduced a special trap for chipmunks which they call "lobster pot" or "muzzle". The principle of this trap is that of fishing creels used in the north of the Narym Territory, in the Achinsk taiga and on the Altai. These traps are used in spring, during the rut period. A female is placed in a small cage which is placed inside the creel. The trap is arranged on a fallen tree, and the hunter hides nearby, calling the males with a whistle, imitating the voice of the female. The males enter the creel and on a good day as many as 50 specimens can be caught.

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* I. M. Zalesskii and M. D. Zverev describe this cry as a short whistling differing sharply from the cry of the male which consists of repetition, at intervals of 10-15 seconds, of "tyurlyu-tyurlyu".

The fur of the chipmunks is of high quality in spring as the molt begins in summer, in females later than in males.

ECTOPARASITES. According to K.A. Plyater-Plokhotskii (1932) the chipmunk is parasitized by mites (species not recorded) and fleas (Ceratophyllus tamias) (identified by Prof. Yu. N. Wagner).

Subspecies of Eutamias sibiricus

The subspecies of Eutamias sibiricus are not well differentiated, because they differ mainly in the variable color characters. Cranial characters give no reliable means of distinguishing the subspecies. However, the following races can be differentiated in series.

377. Eutamias sibiricus sibiricus Laxmann (1769). Central Siberian chipmunk

1769. Sciurus sibiricus Laxmann ME , Sibirische Briefe, Göttingen und Gotha, S. 69-71.
1859. Tamias pallasi Baird S.F., Mammals of North America, Philadelphia, p. 295.
1867. Tamias striatus Middendorf A. Th., Sibirische Reise, Säugethiere, S. 83.
1880. Tamias pallasi Tell in Nordenskjold, "Ekspeditsiya k ust'yu Eniseya" (An Expedition to the Estuary of the Yenisei), p. 178.
1884. Tamias striatus Nikol'skii A. M., Puteshestvie v Altaiskie gory (A Journey to the Altai Mountains), Trudy Sankt Peterburgskogo obshchestva estestvoispytatelei, XI, p. 174.
1899. Tamias pallasii Kashchenko N.F., Rezul'taty Altaiskoi ekspeditsii (Results of an Expedition to the Altai), p. 60.
1900. Tamias asiaticus Kashchenko N.F., Opredelitel' mlekopitayushchikh Tomskogo kraya (A Key to the Mammals of the Tomsk Territory), pl. 32.
1912. Eutamias asiaticus altaicus Hollister N., Five New Mammals from Asia, Proceedings of the Biological Society of Washington, p. 182; Mammals Collected by the Smithsonian, Harvard Expedition, Proceedings of the U.S. Natural Museum, 1913, p. 522 (collected near Tapuchi).
1930. Eutamias asiaticus asiaticus Zverev M.D., Obzor gryzunov yuzhnykh chastei Minusinskogo i Khakasskogo okrugov (A Survey of Rodents of the Southern parts of the Minusinsk and Khakassian Districts), Sbornik Srednesibirskogo geograficheskogo obshchestva, p. 83.

TYPE LOCALITY AND DEPOSITION. Vicinity of Barnaul. Holotype collected by Laxmann, apparently lost.

MATERIAL EXAMINED: 180 skins, mostly with skulls.

DIAGNOSIS. Color saturated, without the yellow tones typical of the West Siberian subspecies (see below). Anterior part of back rust-yellow-gray. Black, relatively broad stripes on the back. Buttocks with an intense rust-red-yellow tinge (between pinkish cinnamon and cinnamon). Top of head more rust-colored than in West Siberian chipmunks, e.g., in the Surgut form (see below). Rust color of head mixed with many chestnut-black hairs which give a darker color.

Length of skull 37.6-41 mm (M. 39.1 mm); condylobasal length 33.9-38.5 mm (M. 35.8 mm); interorbital space 9.3-11.1 mm (M. 10.2 mm); zygomatic width 20.8-23.1 mm (M. 22.6 mm); length of upper tooth row 6-7 mm (M. 6.4 mm); Length of body 127-168 mm (M. 149.2 mm); tail 79-115 mm (M. 106.8 mm); hind feet 31-37 mm (M. 34.8 mm).

SYSTEMATIC NOTES. The Siberian chipmunk is named Eutamias asiaticus Gmel. (1788) in most publications. Its exact range is given by I.F. Gmelin as Northern Dvina and Kama. The name asiaticus is therefore applicable to the European-West Siberian race of Eutamias. Gmelin's description had been preceded by a forgotton description in

M.E. Laxmann's "Sibirische Briefe", under the name Sciurus sibiricus. Laxmann gives the following diagnosis:"... cinereo-rufescens, striis quinque nigris longitudinalibus, palmis tetradactylis, plantis pentadactylis" (p.69). It is called "Burunduk" and the first specimen was caught in the vicinity of Barnaul. The valid name of the chipmunk is therefore Eutamias sibiricus, according to the law of priority.

S.F. Baird (loc. cit., 1859) gives the following short description: "Finding the Siberian animal thus without a name, I have called it Tamias pallasii". In a footnote he says: "In the Siberian species the color of the upper parts is a dirty ocher yellow: in the American, brownish rust, with much gray intermixed on the back..."

The name Tamias pallasii Baird together with the general terra typica, Siberia, has to be considered as a synonym of Eutamias sibiricus sibiricus Laxm.

485 This form differs clearly in series from the lighter, more yellowish West Siberian and Ural-European forms. One may find specimens in the range of the western form which practically do not differ from central Siberian specimens. There are also intermediate forms, e.g., in the vicinity of Tobolsk and in Bashkiria. However, the differences between the western and central Siberian specimens are clearly shown in series.

GEOGRAPHICAL DISTRIBUTION. Central Bashkiria, the south of the Tobolsk Territory, throughout the Irtysh area, the Semipalatinsk ribbon pine forests, the Tomsk and Yeniseisk territories, the south of the Turukhansk Territory, central and southern Yakutia and Transbaikalia to the upper reaches of the Amur, and to the Great Khingan range and the Kirin Province of Manchuria (details on Map IX).

378. Eutamias sibiricus striatus Pallas (1778). West Siberian or European chipmunk

1778. Sciurus striatus Pallas P.S. (nec Sciurus striatus Linnaeus, 1758). Novae species quadrupedum e Glirium Ordine, pp. 378-384; Auct. cit., Zoographia Rosso-Asiatica, 1811, pp. 187-189.

1788. Sciurus striatus asiaticus Gmelin J.F., in Caroli Linné, Systema Naturae, Vol. I, pp. 150-151 ("Habitat: in omni Asia boreali as fluvio europaeus Dwina et Kama usque").

1856. Tamias striatus Brandt I.F., Pozvonochnye zhivotnye Severno-evropeiskoi Rossii i v osobennosti Severnogo Urala (Vertebrates of North European Russia, especially of the Northern Urals), in Hoffman, "Northern Urals" (Severnyi Ural), Sankt Peterburg, pp. 30-31.

1873. Tamias striatus Bogdanov M.N., Okhotnich'i i promyslovye zveri i ptitsy Evropeiskoi Rossii (Game and Commercial Mammals and Birds of European Russia), "Okhota i konnozavodstvo", No. 4, p. 96.

1877. Tamias asiaticus var. borealis, Coues and Allen, Monographs of North American Rodentia, Report of the U.S. Geological Survey of the Territory, Vol. XI, Washington, pp. 793-794 (Habitat: "North Europe, North Asia and North America").

TYPE LOCALITY AND DEPOSITION. In "Novae Species Glirium", 1778, p. 378, Pallas writes: "per omnem Kamae fluvii tractum et ad Dwinam fere explicavit, quemadmodum per omnes Uralensium montium frigidiores sylvas copiose passim occurrit."

Forests near the Kama river may be considered as the type locality of this race. Type lost.

MATERIAL EXAMINED: 239 skins and skulls.

DIAGNOSIS. Color light yellowish, without well marked reddish rust tones. Anterior part of back buff-yellow-gray. (cinnamon-buff) with a well marked gray tone. Black stripes narrow. Buttocks with dull rust-red-yellow tinge (pinkish cinnamon). Top of head light rust-yellow with marked admixture of chestnut-black hair.

Length of skull 38.2-40.2 mm (M. 39.2 mm); condylobasal length 34.3-37.3 mm (M. 35.8 mm); interorbital space 9.2-11.mm (M. 10.4 mm);

zygomatic width 21-22.1 mm (M. 21.6 mm); length of upper tooth row 6-6.9 mm (M. 6.3 mm); length of body and head 130.8-160 mm (M. 150.1 mm); tail 105-118 mm (M. 110.7 mm); hind feet (without claws) 30.5-38 mm (M. 35.2 mm).

486 SYSTEMATIC NOTES. Large series of this form differ clearly from the central Siberian form in the more yellowish color and narrower stripes on the back. Buttocks with less marked rust tones than in E. sibiricus sibiricus Laxm.

Specimens from the vicinity of Tobolsk are intermediate between E. sibiricus sibiricus Laxm. and E. s. striatus Pall. in their color. The same applies to specimens from the middle reaches of the Belaya river in Bashkiria.

Specimen No. M. 4437 of my collection was caught by V. Ya. Parovshchikov near the Tundra station of the Northern Railway in the Khalmogory District (former Arkhangelsk Province). It has a saturated color and a well marked rust tone, like in E. s. lineatus Siebold from Sakhalin.

The name "striatus" proposed by Pallas is not used in modern literature.

The name Sciurus striatus Linnaeus (Systema Naturae, Ed. 10, 1758, Vol. I, p. 64) applies to an American species of a different genus, Tamias striatus L.

The description of S. striatus in Pallas's "Novae Species Quadrupedum" applies to Russian chipmunks. Pallas states (p. 381) that: "Amerikanos Sciuros striatos ipse nunquam vidi..."

According to the law of priority this subspecies should be called E. s. striatus Pallas.

GEOGRAPHICAL DISTRIBUTION. The boundary of its range runs from Vologda and Kholmogory in the west to the southeast, reaching the lower reaches of the Kama, but not the Volga. The boundary crosses the northern districts of the former Kostroma and Nizhni Novgorod provinces. It does not pass to the right bank of the Kama but runs from this river to the Urals (see map) and continues towards Tobolsk. It includes the basins of the Ob and Yenisei and the lower and middle reaches of the Stony Tunguska. The boundary turns north along the Yenisei, including the region of the Kureika river in the north to 68°N (see above).

379. Eutamias sibiricus jacutensis Ognev (1936). Yakut chipmunk

1886. Tamias striatus Maak R., Vilyuiskii okrug (The Vilyuisk District), Vol. II, Sankt Peterburg, p. 143.

1887. Tamias striatus Bunge A., Berichte über die Expedition nach den Neusibirischen Ins., S. 38.

1903. Eutamias asiaticus Allen J. A., Report on the Mammals Collected in Northeastern Siberia, Bulletin of the American Museum of Natural History, Vol. XIX, pp. 137-139.

1926. Eutamias asiaticus Ognev S. I., Mlekopitayushchie severovostochnoi Sibiri (Mammals of Northeastern Siberia), pp. 86-89.

1928. Eutamias asiaticus Dukelski N. M., Materialien über die Säugetier-Fauna des Jakutien Gebietes. Zoolog. Anzeiger, Bd. 78, H. 5-8, S. 107.

1934. Eutamias asiaticus asiaticus Tugarinov A. Ya., Smirnov N. A. and A. N. Ivanov, Ptitsy i mlekopitayushchie Yakutii (Birds and Mammals of Yakutia), pp. 28, 39, 47, 56.

1936. Eutamias sibiricus jacutensis Ognev S. I., Sistematicheskii obzor burundukov (A Systematic Survey of Chipmunks), Uchenye zapiski Moskovskogo universiteta, Issue IV, 1935 (1936), p. 93.

TYPE LOCALITY AND DEPOSITION. Vicinity of Yakutsk, Type No. M. 2290 male, 21 September 1927 (collected by K. E. Vorob'eva), in S. I. Ognev's collection.

MATERIAL EXAMINED: 55 skins and skulls.

DIAGNOSIS. Lighter whitish yellow color of anterior part of back. Reddish rust tones of buttocks pale, and with admixture of white. Stripes on back narrow. Top of head pale rust-yellow with some chestnut-black hair.

Length of skull 38.8-41 mm (M. 39.5 mm); condylobasal length 35-36.5 mm (M. 35.6 mm); interorbital space 10.3-11.6 mm (M. 11 mm); zygomatic width 21.2-22.6 mm (M. 22.mm); length of upper tooth row 6.1-7 mm (M. 6.5 mm).

SYSTEMATIC NOTES. One of the forms with the lightest color and the narrowest stripes . Its color closely resembles that of the West Siberian subspecies (e. g., the Surgut and Ural chipmunks), but it lacks the rich yellow color of this subspecies. In series the Yakut chipmunk clearly appears more whitish.

GEOGRAPHICAL DISTRIBUTION. The range includes a wide area from Khatanga, Olenek and Vilyui to the Anadyr in the west and the Penzhina in the east. In East Siberia the southern boundary passes near 60° N, to about 120° E. Farther west the boundary turns north (see Map IX).

380. Eutamias sibiricus orientalis Bonhote* (1898). Ussuri chipmunk

1858. Tamias striatus Schrenck L. v., Reisen und Forachungen in Amur-Lande, I, S. 124-125 (partim!).

1870. Tamias striatus Przheval'skii N. M., Puteshestvie v Ussuriiskom krae (A Journey to the Ussuri Territory), Sankt Peterburg, pp. 256-257.

1899. Tamias orientalis Bonhote J. L., On a New Species of Tamias. Annals and Magazine of Natural History, 4(7):385-386.

1912. Eutamias asiaticus orientalis Ognev S. I., O kollektsii mlekopitayushchikh iz Ussuriiskogo kraya (A Collection of Mammals from the Ussuri Territory), Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, XVI, pp. 497-500.

1923. Eutamias asiaticus orientalis Sowerby A., The Naturalist in Manchuria, II-III, pp. 148-149.

TYPE LOCALITY AND DEPOSITION. The Sungacha river, upper reaches of the Ussuri, Holotype in the British Museum.

MATERIAL EXAMINED: 20 skins and skulls.

DIAGNOSIS. Color rich, with well marked saturated red-rust shades (orange-cinnamon), especially on the buttocks. Top of head with well 488 marked reddish rust tones. Infraorbital stripe and middle of cheeks of the same rich color.

Skull larger than in other forms. Length of skull 39.2-41.8 mm (M. 40.2 mm); condylobasal length 36.1-38 mm (M. 37.1 mm); interorbital space 10.2-11.3 mm (M. 10.8 mm); zygomatic width 22-23.8 mm (M. 22.8 mm), length of upper tooth row 6.1-7.1 mm (M. 6.6 mm); length of body and head 148 mm; tail 114.2 mm; hind foot 36 mm.

SYSTEMATIC NOTES. This form differs clearly in series from others in its rich, saturated rust-red color of the buttocks. Skull larger than in the other subspecies.

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* In Chaworth-Musters's opinion (A Note on the Nomenclature of Two Sciurids from Eastern Siberia. Ann. Mag. Nat. History, 13(10):555-557, 1934), orientalis Pall. is synonymous with uthensis Pall. (see below).

This is not correct. I have shown that the name Sciurus uthensis applies to a melanistic specimen from the village Udskoi, i. e., from the range of the central Amur race Eutamias sibiricus lineatus. As this is a melanistic specimen it is correct to use the name proposed by Siebold (see below).

GEOGRAPHICAL DISTRIBUTION. Southern part of the Maritime Territory, the Ussuri Territory, Manchuria. Specimens from the eastern side of the Great Khingan and Kirin Province of Manchuria are more closely related to the nominate form than to orientalis. The range of E. sibiricus sibiricus in the Kirin Region is wedged into the range of orientalis.

381. Eutamias sibiricus lineatus Siebold (1826). Amur chipmunk

1811. Sciurus uthensis Pallas P., Zoographia Rosso-Asiatica, pp. 189-190 (description of a melanistic specimen).

1826. Myoxus lineatus Siebold Ph. F., De historia naturalis in Japonia Statu, etc., Wirgerburgi, pp. 16, 17.

1851. Tamias uthensis Simashko Yu., Russkaya fauna. II. (Russian Fauna. II), p. 603.

1858. Tamias uthensis Schrenck L., v., Reisen und Forschungen im Amur-Lande, I, p. 123.

1867. Tamias (Sciurus) uthensis Middendorf A. Th., Sibirische Reise, S. 83.

1889. Tamias asiaticus borealis Nikol'skii A. M., Ostrov Sakhalin i ego fauna pozvonochnykh zhivotnykh (The Vertebrate Fauna of Sakhalin Island), pp. 125-126.

1890. Tamias pallasii Suprunenko, Pozvonochnye Sakhalina, (The Vertebrates of Sakhalin), p. 39.

1922. Tamias uthensis ochotensis Dybowski Ben., Arch., Tow. Naukow. Lwowie, III, p. 8.

1936. Eutamias sibiricus lineatus Ognev S. I., Sistematicheskii obzor burundukov (A Systematic Survey of Chipmunks), Uchenye Zapiski Moskovskogo universiteta, Issue IV, 1935 (1936), p. 94.

TYPE LOCALITY AND DEPOSITION. Yezo Island (Hokkaido). Holotype not known.

MATERIAL EXAMINED: 37 skins (most of them with skulls).

DIAGNOSIS. Closely related to E. s. orientalis but differing from it in its paler color, especially on the buttocks where the rust-red tones are not as saturated as in orientalis. Top of head also lighter and yellower than in orientalis.

This form is intermediate between orientalis and jacutensis.

Length of skull 38.2-39.3 mm (M. 38.9 mm); condylobasal length 35.2-37.2 mm (M. 36.1 mm); interorbital space 10.3-11.1 mm (M. 10.7 mm); zygomatic width 20.3-22.4 mm (M. 21.5 mm); length of upper tooth row 6.2-6.9 mm (M. 6.5 mm); length of body and head 139-147 mm; length of tail 112-124 mm; hind feet 33-37 mm.

489 SYSTEMATIC NOTES. Pallas ("Zoographia Rosso-Asiatica", p. 189-190, 1811) describes "Sciurus uthensis" from a melanistic specimen caught on the Uda river as follows: "tota pellis nitidissime atra, paulo minor Sc. striato; auriculae paulo minores et cauda proportione brevior, quam in eodem. Pedum structura, digitis pollice subunguiculato verruciformi palmarum, et parte nuda simillimi Strige dorsi item similes. Sub collo tractus longitudinalis albus, a labio inferiore ad sternum continuus; caeterum pars prona tota nigra. Cauda tereti — pilosa, sed minus late villosa, pilis magis uniformibus, strictius laevigatis ubique aterrimis"...

As Pallas described a melanistic specimen, it would be correct to apply the subspecific name "lineatus" to the Sakhalin-Amur form. Ph. F. Siebold 1826, loc. cit.) gave the following description of Myoxus lineatus: "M. lineatus tergo lineis quinque longitudinalis nigrescentibus notato, habitat in insula Yezo. Longitudo corporis 6 1/2 poll., caudae 4 1/2 poll.".

According to Nagamichi Kuroda, who published a survey of chipmunks in 1932, the islands of Yezo [Hokkaido] and Sakhalin are inhabited by the same subspecies, namely lineatus. As I have not seen any specimens from the

Yezo Island, I have to accept the opinion of Kuroda. His conclusion is reasonable as the fauna of Yezo and Sakhalin are closely related.

GEOGRAPHICAL DISTRIBUTION. E. s. lineatus occurs on the islands of Yezo and Sakhalin, on the Shantar Islands, in the middle and lower reaches of the Amur and along its tributaries Khor, Goryun, Khungari, etc.

Felis (Eremaelurus) thinobius Ognev
The sand or barchan cat.

Several publications on the systematic position of the barchan cat, a peculiar representative of the Russian fauna, have appeared recently. W. Heptner and G. Dementiev published an article "Sur les relations mutuelles et la position systématique des chats desertiques Eremaelurus thinobius Ognev et Felis margarita Loche" ("Mammalia", Vol. I, 1937, Paris, pp. 217-242).

V. G. Heptner and G. P. Dementiev became interested in this question through an article of H. Heim de Balzac ("Biogéographie des Mammiferes et des Oiseaux de l'Afrique du Nord", supplément XXI au Bulletin Biologique de France et de Belgique, Paris 1936, pp. 87, 171-172, 239, 258, 393). H. Heim de Balzac suggests that Eremaelurus thinobius is closely related to the Sahara sand cat which was described by Loche (1858) but its systematic position was not clear because of lack of material.

Heptner and Dementiev obtained a specimen of Felis margarita male ad., caught 29 May 1930 in Algeria (Lagouat) from the Musée National d'Histoire Naturelle de Paris.

A comparison of the skin and skull of this specimen with Eremaelurus thinobius showed that these two species are closely related. In their opinion, thinobius is merely a subspecies of margarita. After study of the skull, although they had only limited material, they came to the conclusion that the genus Eremaelurus should be considered as a synonym of the genus Otocolobus (to which Felis manul belongs).

The paper of Heptner and Dementiev attempts to solve two problems: 1) whether the genus Eremaelurus should be considered as a synonym of Otocolobus; 2) what is the relationship between margarita and thinobius.

The authors give a positive answer to the first question because the skull of Felis manul and Eremaelurus resemble each other in a number of characters: the ratio of the length of the zygomatic arches to the greatest length of the skull, the ratio of the zygomatic width to the condylobasal length, and the ratio of the length of the bullae osseae to the condylobasal length.

The two last ratios are of little value. The skull of Otocolobus is much shorter than that of Eremaelurus, and the condylobasal length is small. Although the bullae osseae of Otocolobus are much smaller 491 than those of Eremaelurus, the ratio of the length of the bullae to the small condylobasal length give a similar ratio. The authors also indicate that the chambers of the bullae osseae of Eremaelurus and Otocolobus are of similar structure. However, in addition to these similarities there are a number of differences. The authors state that the two genera differ in twelve important characters (pp. 234-235). If differences not mentioned by Heptner and Demetriev are added to these twelve, it appears that Otocolobus and Eremaelurus differ sharply.

We shall mention here only the most important differences; 1) the orbits of Otocolobus are smaller than those of Eremaelurus, more rounded and directed more forwards; 2) the bullae osseae are much smaller; 3) the limit between the anterior and posterior chambers of the bullae osseae is much sharper in Otocolobus than in Eremaelurus, and the anterior chamber is generally smaller; 4) talon of pm^4 much smaller; 5) rostrum much shorter; 6) jaws and tooth rows shortened; 7) coronoid process shorter and wider, or a quite different form from that of Eremaelurus. The form of the coronoid process in Felis manul is very peculiar, and differs from that of Felis silvestris and Felis ornata.

Felis manul and Eremaelurus do not differ only in characters of the skull. Felis manul differs sharply from Eremaelurus in its short ears, its luxuriant fur and the unique pattern of the fur of the tail. The range of Felis manul is restricted mainly to the highlands of Central Asia. Eremaelurus has large ears, its feet are covered with luxuriant black fur and the fur on the back is pale and not smooth. It is a typical inhabitant of the desert. The shagginess of the soles resembles that of hares or other rodents of sand deserts (e.g., jerboas) and are apparently an adaptation to life in the barchans.

For the sake of "simplification" generic or subgeneric classifications may be ignored, and subgenera may be placed into a generally accepted genus, as it has been done by R. Pocock.

However, to place two species which differ morphologically and ecologically like Eremaelurus and Otocolobus, into the same genus as Felis manul is shortsighted and difficult to understand in a mammalogist or ornithologist. It would cause only confusion. R. Pocock (1938) made some critical remarks on the work of Heptner and Dementiev, but he ignored their suggestion to place thinobius and margarita in the genus Otocolobus. This question seemed apparently of little interest to Pocock.

This discussion attempts to clarify the problem for those readers who may be misled by the article of Heptner and Dementiev.

It seems impossible, in our opinion, to unite Eremaelurus with Otocolobus. As Eremaelurus shows some characters intermediate between Felis and Otocolobus, and as Otocolobus is better
492 differentiated than Eremaelurus, we consider it correct to regard Eremaelurus as a subgenus of Felis.

Heptner and Dementiev also gave a positive answer to the second question and named the Transcaspian sand cat "Otocolobus margarita thinobia".

Let us now examine whether this problem is so simple.

R. Pocock recently described two subspecies of Felis margarita*. The first subspecies was collected near Niogus [?] on the border between Tripoli and Algeria, and was named Felis margarita meinertzhageni Pocock. The other subspecies was caught in In-Abbangarit, west of Air (southwestern Sudan) and named Felis margarita airensis Pocock.

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* R. Pocock, The Algerian Sand Cat (Felis margarita Loche), Proceedings of the Zoological Society of London, Series B, Vol. 108, pp. 41-46, 1938; A New Race of the Sand Cat. Annals and Magazine of Natural History, Series 11, Vol. I, pp. 472-476.

R. Pocock describes the differences between F. thinobius and F. margarita and comes to the conclusion that thinobius is a separate species. In his opinion, margarita and thinobius developed from F. ocreata. He also considers Felis ornata and Felis caudata as subspecies of ocreata. In Pocock's opinion, thinobius and margarita evolved from ocreata in geographically isolated regions, as their range was interrupted. He therefore interprets the common characters of these species as convergences, which evolved in adaptation to desert life.

Without discussing the arguments of Pocock, the problem certainly seems more complicated than Heptner and Dementiev thought.

I cannot solve this problem for lack of material (we have only one skin and skull of F. margarita and several specimens of F. thinobius). However, if the careful descriptions of R. Popcock (who is a renowned expert on carnivora) are compared with our specimens, some differences between F. margarita and F. thinobius can be pointed out.

Adult males of the Transcaspian sand cat differ from F. margarita as follows: 1) much larger size; 2) larger bullae osseae; 3) the occipital region is lower in relation to the length of the skull (this difference was also noted by R. Pocock); 4) relatively shorter nasals; 5) large orbits; 6) rostrum of thinobius generally longer than that of margarita in spite of the relatively short nasals; the long nasals of F. margarita project further backwards; 7) the color of F. margarita is paler than that of F. thinobius.

493 All our data prove that Felis (Eremaelurus) thinobius Ogn. should be considered as a good species which belongs to the same subgenus as F. (E.) margarita Loche.

The ranges of these species are adjacent. F. margarita occurs in the western Sahara desert and reaches Algeria in the north. Heptner and Dementiev confidently populate Egypt with Eremaelurus (loc. cit., p. 240), referring to an article by S. Flower ("The Recent Mammals of Egypt", Proceedings of the Zoological Society of London, 1932, p. 249). However, Flower only assumes that F. margarita occurs in the western Egyptian desert. Eremaelurus has not been found so far in the wide area including eastern Tripoli, Egypt, Arabia, Syria, Palestine and Iran, although this was explored by many zoologists. It is not probable that it will be found in this region.

To conclude, it is very interesting that an African and a Turkmenian species of the same highly specialized subgenus are so similar and closely related.

TABLE 1

Measurements of the Alpine pika Ochotona alpina Pall.

Subspecies	Ochotona alpina alpina Pall.														
	No. 149 senex! 22 July 1897. Valley of Tikhaya river, central Altai. A.Silant'ev, ZMAN collection	No. 149 sex? 1897. Mountain pass near Kuz'mushka river, central Altai. A.Silant'ev	No. M.3973 ♂ 12 Dec. 1929. Vicinity of Argaty, Katon Karagai, southern Altai. A.Silant'ev	No. M.3972 ♂ 10 Dec. 1929. Ibidem	No. M.3970 ♂ 18 Dec. 1929. Ibidem	No. M.3969 ♀ 12 Dec. 1929. Ibidem	No. M.3971 sex? 18 Dec. 1929. Ibidem	No. M.3975 ♀ 19 July 1929. Ibidem	No. M.3976 ♀ 10 Dec. 1929. Ibidem	No. M.3979 ♀ 6 June 1930. Katon Karagai, southern Altai	No. M.3968 ♂ 18 Dec. 1927. Argaty, Katon Karagai	No. M.3978 ♂ 24 May 1930. Vicinity of Katon Karagai	No. M.3967 ♂ 26 Dec. 1929. Vicinity of village Usyl', southern Altai	No. M.3966, 15 Dec. 1929. Argaty, southern Altai	No. M.3977 ♀ subad. 17 Dec. 1929. Uryl' Village, Altai, right bank of the Bukhtarma
Length of skull	57.3	51.3	51	51.6	49.9	49	52.9	51.3	50	52.8	51.9	51	50.6	48.2	45.5
Basal length of skull	46.7	42	40.3	41	40.1	40.2	42.3	40.7	40.8	42.2	41.5	40.2	41	38.6	36
Condylobasal length	53.8	47.6	48	48.2	46.7	46.2	49.2	48	47.2	49.8	48.1	47.1	47.1	45	42
Length of nasals	19	15.2	16.6	16	15.5	14.6	15.1	16.2	15.7	17	15.9	16.2	d.	15.2	14
Zygomatic width	26.3	23.6	24.1	24.6	24	22.3	24.3	23.2	25	24	24	24.1	23.3	23	22.1
Interorbital space	6	6	5.1	6	6.2	5.8	6	6	6.3	5.2	5.2	5.7	5.6	5	5.3
Width of skull posterior to zygomatic arches	15.2	15.2	14.7	16	15.8	15	15.1	15	16.1	14.2	15.3	16	15	15.5	14.3
Width at level of auditory apertures	25.7	25.2	24.1	24.6	24.3	22.2	23.7	23.7	24	23.2	24	24	[?]4	22.7	21.5
Length of facial area	26	23.5	23	23.2	23	22.1	24	22.7	23	24	23	22.5	23	21.5	20
Length of braincase	27.7	24	25	25.2	23.6	24.3	25	25	24.1	25.2	25.2	24	23.6	22.2	21.2
Length of frontal suture	16	17.3	16.2	15.6	15.8	15.2	16.2	16.2	16.2	15.2	17.2	16	14.2	15.7	14.8
Height of occipital area	13.1	12	12.3	12.2	12.2	12	12	12.2	12.2	12.2	12.2	13.2	12.2	11.7	12.2
Length of bullae osseae	16.4	15.7	15.2	15.7	15.7	14	14.9	15	15.1	15	16	14.8	14.9	13	13.2
Width of bullae osseae	10.3	11.2	10.1	10	10.6	10	10.3	11	10.1	10.3	9.8	11.2	11	10	9.3
Length of palatine foramen	9	7.7	7.3	7.6	8.8	7	8	7.1	7.5	7.3	8	7.2	7.7	7.2	6.6
Diastema	12.9	11.7	10.6	10.7	10.2	9.6	11	10.2	10.3	10.3	10	11	10.3	10.2	8.3
Length of upper tooth row	9.6	9	9	9.1	9.1	8.8	9	9.1	9.1	9.1	9.1	9	9	8	8.6
Length of mandible	—	32.2	35	36	33.4	31.5	35.1	34	33.3	35	34.2	34	34	32	30
Height of mandible	—	18.3	19.8	20.2	19.5	17	18.8	18.2	18.7	18.2	19.2	19.2	18.6	17.2	16.6
Body length	—	—	217	218	—	—	—	—	29	—	211	—	—	—	205
Length of feet	—	—	28	29	—	—	—	—	17	—	28	—	—	—	26
Length of ears	—	—	18	20	—	—	—	—	—	—	23	—	—	—	19

TABLE 2

Measurements of the Alpine pika Ochotona alpina Pall.

Subspecies	Och. a.alpina Pall.					Ochotona alpina nitida Hollister										
	No. 2371 (624) ♀ 14 Aug. 1929. Katon Karagai. B. A. Kuznetsov	No. 2369 (620) ♀ 13 Aug. 1929 Ibidem	No. 2374 (633) ♀ 14 Aug. 1929. Ibidem	No. 9487 ♂ 28 July 1930. Central Altai, Karachai river. A. Razorenova	No. M. 3748 sex? 29 July 1930. Central Altai, Karachai river. A. Razorenova	Ochotona alpina alpina Pall. Average	No. 120 ♀ 16 Aug. 1935. Altai, Teletskoe Lake, Altyn Tu. A. M. Kolosov	No. 1 sex? 14 June 1935. Yanchili river, Teletskoe Lake 1500 m. A. Kolosov	No. 4 ♂ 19 June 1935. Bozhogolets river, 1900 m. Altyn Tu. A. Kolosov	No. 104 sex? 13 Aug. 1935. Altyn Tu 2000 m. A. Kolosov	No. 681 ♂ 21 Sep. 1935. Komushru river	No. 678 ♀ 8 Sep. 1935. Ibidem	No. 667 ♀ ad. 8 Sep. 1935. Komushru river, Chulyshman Area	No. 574 ♂ ad. 21 Aug. 1935. Kara Kol'. S. S. Folitarek	No. 668 ♂ ad. 8 Sep. 1935. East Altai	No. 679 ♀ ad. 8 Sep. 1935 Ibidem
Length of skull	50.2	48.2	47.2	48.5	46.5	50.2	48	45	48	46	46	46	46.3	50.8	47.2	48.2
Basal length of skull	40	37	36.2	d.	37.2	40.2	38.6	36	39.8	36.7	37.5	36.6	36.3	—	37.2	39.2
Condylobasal length	48.2	44	42.8	d.	43.2	46.8	44.9	41.1	45.2	42.1	42.3	41.5	43.1	—	44.2	44.9
Length of nasals	16.2	15	14.3	16.2	15.3	15.7	15.7	13.3	15	14.2	15	14.1	14.3	16.5	14.2	14.3
Zygomatic width	23.2	23.2	22.3	22.6	22	23.6	23.1	21.6	23	22.1	22.1	23.2	22.2	24.1	22.2	21.7
Interorbital space	6	6.2	6	6.2	6	6.1	5.7	5	6	5.6	5.5	6.2	5.2	5.8	5.1	5.2
Width of skull posterior to zygomatic arches	15.2	16	14	15.3	14.2	15.2	15.2	14.2	14.9	14	14.7	15	14.9	15	14.9	14.6
Width at level of auditory apertures	24.1	23.2	23	d.	22.1	23.6	22.2	23	23	22.7	21.2	21.3	21.6	—	21.9	21.8
Length of facial area	22	21	20.2	22.2	20.9	22.5	22	20	21.8	20.2	20.7	20	21.3	22.6	21	21.2
Length of braincase	23.2	23	22	d.	22	24.0	22.1	21.1	23.1	21	22.1	22.1	21.2	—	22.3	23
Length of frontal suture	15.2	15	14.7	14.3	15	15.6	14.3	15	14.3	14.2	15	13.6	15	15.1	15.3	14.9
Height of occipital area	13.2	13.9	12.2	d.	11.1	12.3	11.7	12.3	13	12.	10.7	11.4	11.6	d.	11.3	11.5
Length of bullae osseae	14.2	14.2	14.1	14	13.9	14.8	13.2	13.2	14.2	13.8	13.3	13.3	14.2	d.	13	14.1
Width of bullae osseae	11.2	10.2	10.9	—	9.5	10.4	9.2	10.5	9.7	10	9.8	10.2	10.1	d.	9.3	9.3
Length of palatine foramen	8.3	7.2	7.9	6.8	6	7.5	7	7.1	7.1	6.3	7.3	7.2	6.3	6	6.9	7.5
Diastema	10	9.3	9.6	9.2	9.2	—	9	7.3	8.6	7.7	7.3	8.2	8.7	8.1	7.7	8.2
Length of upper tooth row	8.8	8.2	8.2	8.2	8	8.8	10.8	9.2	10.2	10.6	9.2	9.6	9.2	10.8	10.3	10.3
Length of mandible	32.2	—	29.8	31.2	30	32.9	27.7	29.3	31.6	29.1	30	30.2	30.2	32.7	31.1	30
Height of mandible	18	—	16.3	17.2	16.8	18.2	16	17.2	18.3	17.3	17.4	17.2	16.7	18.7	17.7	17.2
Body length	188	196	200	175	185	189.4	200	220	220	180	200	195	193	213	208	195
Length of feet	31	34	32	29	28	29.4	30	31	35	30	29	27.5	28.5	32	30	31
Length of ears	24	22	23	22	20	20.8	25	27	22	20	19	21	21	21	21	—
REMARKS:	adult.	adult.	adult.	—	subad.						Weight 192 g	Weight 203 g	Weight 202 g	Weight 267 g	Weight 233 g	Weight 197 g

TABLE 3

Measurements of the Alpine pika Ochotona alpina Pall.

Subspecies	Ochotona alpina nitida Hollister								Ochotona a. changaica subsp. nova				Och. a. scorodumovi Scalon	Ochotona alpina avatoshi Turov.		
	No. 412 ♀ ad. 1 Aug. 1935, Chulyshman, east Altai	No. 414 ♀ ad. 1 Aug. 1935, Chulyshman, east Altai	No. 146. Chegan-Burgazy. A. M. Kolosov	No. 240. Ibidem	No. 195. Ibidem	No. 178. Ibidem	No. 11-1900 sex? 1897. Borus foothills, Minusinsk District, ZMAN collection	Ochotona alpina nitida Hollister. Average	No. 26-1925 (24) 14 Aug. 1924. Mongolia, Hangay. P. K. Kozlov	No. 26-1925 (23) 15 Aug. 1924. Ibidem	No. 20, 220 sex? 8 July 1929. Southwestern Hangay, Mongolia. P. K. Kozlov	Ochotona alpina changaica subsp. nov. Average	No. 25009 ♂ Och. a. scorodumovi 14 Sep. 1934. Transbaikalia. V. N. Skalon	M. 3985 sex? Summer 1922. Sosnovka, Barguzin Reserve. S. S. Turov.	S. 4610 ♂ 19 Aug. 1923. Ibidem	S. 4811 ♀ 19 Aug. 1923. Ibidem
Length of skull	51.1	50	51	45.7	47.3	45.2	47	47.6	48.6	46.6	48.9	48.0	46.5	46	42.4	47.2
Basal length of skull	36.7	40.6	41.9	35.5	37.7	d.	38	37.9	39.2	37.5	38.6	38.4	38.1	36.3	37.6	38.3
Condylobasal length	43.3	46.6	48	42.3	43	d.	44	43.7	45.2	42.7	45	44.3	43.3	42.7	44	45
Length of nasals	15	d.	15.7	14	15.2	15.7	15.6	14.9	15.2	15	15.3	15.1	14.3	15	14.9	15
Zygomatic width	23	23.1	23.3	21.2	22.2	d.	22.3	22.5	22.6	22.5	23	27.7	22	d.	22	22.2
Interorbital space	6	5.2	5	5	5.8	5.1	5	5.4	5	6	5	5.3	5.2	5.3	5	5.1
Width of skull posterior to zygomatic arches	15	14.8	15	14.2	15	d.	15	14.8	14.2	15	15.2	14.8	14.3	d.	14	14.6
Width at level of auditory apertures	22.3	23.1	23	22	23	d.	23	22.3	23.2	22.7	23.2	23.0	22.6	22.5	d.	23.1
Length of facial area	20.8	22.7	23	21.3	21	21	21.3	21.3	22.1	21.2	22.2	21.8	20.9	20.6	21	21.6
Length of braincase	22.1	23	24	20.8	21.3	d.	22.7	22.1	22.3	21	23.1	22.1	22.2	22.1	22.1	22.5
Length of frontal suture	14.9	16.5	16	15.2	14.2	14.6	15.2	14.9	16.2	14.6	15	15.3	14.8	14	17.1	19
Height of occipital area	11.5	12	13.2	11.6	12.1	d.	11.9	11.9	11.2	12.2	12.3	11.9	11.9	11.2	11.1	11.3
Length of bullae osseae	14	14.9	15.2	12.6	14.3	d.	14	12.7	14	13.2	14.2	13.8	14	14	13	13.3
Width of bullae osseae	9.7	10.6	11.2	10.2	11	d.	10.3	12.4	10.2	9.3	10.6	10.0	10.2	9.5	9	9.7
Length of palatine foramen	7.1	7.2	8.2	6.3	7.3	6.4	7.3	8.6	7.2	7.2	8	7.5	7.6	6	6.6	5
Diastema	10.1	8.5	9	8	8.2	8.2	8.6	7.6	10.8	8.3	11	10.0	8.8	9.3	9.2	9
Length of upper tooth row	8	10.6	10	9.3	9.3	9.7	10	8.7	8.3	10.2	8.2	8.9	10.2	8.3	9	6
Length of mandible	29.3	32.2	33.2	29	29.2	30.2	30	30.2	31	d.	33	32.0	30.2	29.8	30.2	31
Height of mandible	17.5	18.3	18.2	16.2	17	17.2	18.5	17.4	17.2	d.	18.3	17.8	18.2	16.8	18	18.3
Body length	190	210	—	—	—	—	—	202.0	—	—	—	—	189.5	205	—	—
Length of feet	29	32	—	—	—	—	—	30.4	—	—	—	—	27.6	28.2	—	—
Length of ears	22	20	—	—	—	—	—	21.4	—	—	—	—	20.9	21.7	—	—
REMARKS:	Weight 198 g	Weight 244 g							Senex		adult.					

TABLE 4

Measurements of the Alpine pika Ochotona alpina Pall.

Subspecies	Ochotona alpina svatoshi Turov.						Ochotona a. cinereo-fusca Schrenck			
	No. M.3984 ♀ 19 Aug. 1923. Baikal, Shumilikha river, Sosnovka. S. S. Turov	No. M.3982 ♂ 19 Aug. 1923. Ibidem	No. III, 3983 ♀ 19 Aug 1923. Ibidem	No. M.4350 sex? 1933. Bolshaya Cheremshanka, Barguzin Range	No. M.4263 11 Aug. 1933. Ibidem	Ochotona alpina svatoshi Turov. Average	No. 592 ♀ 25 June 1928. Transbaikalia, Sretensk District, Chivyrkui Bay, village Shivki	No. 590 (54) ♀ 23 June 1928. Ibidem	No. 589 (53) ♂ 23 June 1928. Ibidem	Ochotona alpina cinereo-fusca Schrenck. Average
Length of skull	47	46	44	45	43.5	45.6	44.2	45	48.3	45.8
Basal length of skull	37.3	38	35.2	36.1	34.1	36.6	36.9	36.3	40	37.7
Condylobasal length	43.2	43.9	40.7	42.1	40.6	42.8	42	40.8	44.9	42.6
Length of nasals	15	13.2	13.3	14	14.9	14.4	13.3	13.9	14.6	13.9
Zygomatic width	21.3	21.6	21.3	21.6	21.1	21.6	22	21.4	d.	21.7
Interorbital space	5.2	6	6	5.2	4.8	5.3	5	4.9	5.1	5.0
Width of skull posterior to zygomatic arches	14.1	14.3	14.2	14.1	14	14.2	14.2	14.1	d.	14.2
Width at level of auditory apertures	22.7	22.3	21.6	21.2	21.1	22.1	22.1	21.5	23	22.2
Length of facial area	21.2	20.7	20.2	20.1	19.8	20.6	20	20.5	22	20.8
Length of braincase	22	22.8	20.3	21	21	21.7	22.1	21.2	23.2	22.2
Length of frontal suture	15.6	15.2	14.9	13.3	12.2	15.1	14.78	15.2	d.	15.0
Height of occipital area	10.1	11.1	11.1	11.2	11	11.0	11.1	11	11	11.0
Length of bullae osseae	13	13.5	13	13.8	13	13.3	12.7	12.6	14.2	13.2
Width of bullae osseae	10.2	10	9.3	10	9	9.6	9.5	9.2	10.3	9.7
Length of palatine foramen	5.3	5.6	6.5	7	7.9	6.2	d.	d.	7	7.0
Diastema	9.3	9.9	9	9.9	8.2	8.2	8.2	9.6	10	9.3
Length of upper tooth row	8.2	8.2	8	7.9	7.9	8.3	8.8	8.8	8.9	8.7
Length of mandible	30.3	33.2	29	28.3	28	30.0	29	28.9	30.9	29.4
Height of mandible	17.3	17.2	17.1	16.1	16.3	17.1	17.2	17.1	18.1	17.5
Body length	—	—	—	—	80	192.5	204	298	298	200
Length of feet	—	—	—	—	25	26.6	27.5	30	30	29.2
Length of ears	—	—	—	—	18	20.2	22.3	22	20	21.4

TABLE 5

Measurements of the northern pika Ochotona hyperborea Pall.

Subspecies	Ochotona hyperborea hyperborea Pall.																	
	No. 60-1934 (812) ♀ 13 Oct. 1931 Village Markovo on the Anadyr. L. Portenko	No. 128-1935 (442) ♀ 1 Oct. 1933 Cape Dezhnev	No. 128-1935 (444) ♂ 11 Sep. 1933. Ibidem	No. 60-1934 (815) ♀ 11 Aug. 1932 Emma Bay	No. 60-1934 (807) ♂ 11 Aug. 1932. Ibidem	No. 60-1934 (807) ♂ 11 Oct. 1931. Markovo	No. 60-1934 (816) ♂ 11 Aug. 1932. Emma Bay	No. 128-1935 (449) ♀ 11 Sep. 1933. Cape Dezhnev	No. 128-1935 (440) ♂ 11 Sep. 1933. Ibidem	No. 60-1934 (805) 13 Oct. 1931. Markovo	No. 128-1935 (445) 14Sep. 1933. Cape Dezhnev	No. 60-1931 (811) ♀ 11 Oct. 1931. Markovo	No. M.3468. Winter 1929. Middle reaches of the Anadyr. S. V. Kortselli	No. 39. 1898. Anadyr Territory. Gondatti	No. 6 ♂ 2 Sep. 1930. The Anadyr estuary, rocky tundra. Belopol'skii	No. 69 ♂ ad. 23 Nov. 1930. Anadyr, Ust'-Beloe Village. Belopol'skii	No. 39-97. Anadyr Range. Gondatti	No. 10,765 ♀ 20 July 1912. Providence Bay. Starokadomskii
Length of skull	37	37.2	40.2	35.6	34.2	35.6	35.2	37.5	38	38.2	38	39	35.3	36.6	37	d.	37.7	35
Basal length of skull	30	28.5	—	28	26.2	29.6	28.2	29.6	31	30.3	30.8	30.7	28.3	29.8	30	d.	30	28.3
Condylobasal length	34.2	34.2	—	33.2	32.2	32.8	32.7	35	35.2	35.2	35.3	35.2	32.9	34.5	34.7	d.	35	33
Length of nasals	11	11.2	11.7	10.2	9.8	11.2	11	11.3	10.2	11.3	13.2	—	10	11	10.3	10.2	11.7	11.2
Zygomatic width	18.3	18.9	19.2	18.3	18.2	18.3	18.2	18.6	18.3	18	18.7	—	17.3	18.8	18	17.3	18.6	18
Interorbital space	4.3	4.9	5	4.8	5.2	4.9	4.9	6	5.3	~5.3	5	—	4.2	5.1	5	4.9	5	4.8
Width of skull posterior to zygomatic arches	11	12.9	12.2	13.2	13.2	12.2	13.2	12.6	12.2	12.2	12.3	13.2	12.1	13.1	12.4	12.9	13.1	13
Width at level of auditory apertures	18.4	18.3	19.2	17.5	16.8	18	17.2	17.6	18	18.9	18.8	19.3	17.2	20	19.6	—	19.0	17.2
Length of facial area	17.1	16.4	17.7	15.3	14.8	15.3	16	16.2	17.2	16.4	16.7	17.3	15	16	16.3	14.6	16.6	15.2
Length of braincase	17.3	17.1	18.2	16.3	15.3	18.9	16.6	17.2	17.4	17.3	17.4	18.1	16.6	18.[?]	17.3	d.	18.2	17.6
Length of frontal suture	11.2	11.6	10.5	11.1	10	9.9	10.3	9.9	11.2	—	11	—	10.2	11.1	12.1	11	11.2	11.2
Height of occipital area	9.7	9.5	10.7	9.2	9.5	—	9.5	9.2	9.9	9.3	9.9	9.2	9	9.6	9.8	d.	9.1	9.2
Length of bullae osseae	11.8	10.8	11.3	10	10.2	11.2	9.9	11.2	10.7	11.2	11	11.8	11.1	12.1	11.7	d.	11.7	11.1
Width of bullae osseae	8.2	8.9	8.6	7.8	7.1	—	7.8	7.1	8.3	8.2	8.3	8.3	7.8	9.2	8.6	d.	8.6	8.1
Length of palatine foramen	—	5.3	5	4.6	3.2	—	4.2	5.2	—	—	—	—	4.1	4.2	—	5.1	5.3	4.2
Diastema	8.2	7.2	—	6.1	5.9	6.2	6.7	6.3	7.2	7.2	7.2	7.3	6.5	6.7	7.4	7	7.2	7.1
Length of upper tooth row	7.2	7.2	7.1	6.2	6.2	6.2	6.1	6.2	6.7	6.3	6.3	6.7	6.2	7.1	6.7	6.9	6.7	6.2
Length of mandible	25	24	—	22.8	21.3	23.2	22	—	24.3	24.8	24.2	24.2	22.2	24.7	23.3	22.9	23	22
Height of mandible	14.2	13	—	13	12.5	13.9	12.3	—	13.2	14	14.2	12.1	12.3	13.5	13.5	12.8	13	12.2
Body length	128	152	158	145	138	140	145	145	150	123	140	160	119	—	141	128	—	—
Length of feet	20	23	23	23	22	22	22	22	20	20	23.5	20	20.9	—	23.4	22	—	—
Length of ears	14	13	14	13	12	12	14	14	13	12	14.2	13	12	—	15.2	13	—	—
REMARKS:	Summer fur (transitional)	Winter fur		Transit. summer fur retained on underparts	Young, transit., and summer fur	Winter fur	Transit. fur	Winter fur	Winter fur	Much summer fur. Transit. specimen	Winter fur	Molt into winter fur. Much summer fur						

TABLE 6

Measurements of the northern pika Ochotona hyperborea Pall.

Subspecies	Ochotona h. hyperborea Pall.					Ochotona h. ferruginea Schrenck.						Ochotona h. cinereo-flava Schrenck.				
	No. 39-1893 (2) Anadyr Territory. Gondatti. ZMAN collection	No. 131-1905, 26 Aug. 1905. Kolyma. Buturlin. ZMAN collection	No. 90. Ibidem	No. 79. Autumn 1905. Krestovskaya, Kolyma. Buturlin	Ochotona hyperborea hyperborea. Average	No. 16732 ♀ 7 July 1927. Ken Yuryakh, Upper reaches of the Yana. Tkachenko	No. 16734 ♀ 21 May 1927. Ibidem	No. 16770 ♀ 7 Aug. 1927. Left bank of the Nel'chekhe river, at confluence with Adycha river, Verkhoyansk District	No. 16733 ♀ 5 July 1927. Ken Yuryakh, Verkhoyansk District. Tkachenko	No. 10755, 12 June 1908. Lower reaches of the Lena. E. V. Pfitsenmaier	Ochotona h. ferruginea. Average	No. M.3989, 7 Aug. 1928. Rassvet Bay, Olskii Island, Sea of Okhotsk. G. V. Dul'keit	No. M.3988, 8 Aug. 1928. Ibidem	No. M.3987 ♂ 17 Aug. 1928. Ibidem	No. M.3986, 10 Aug. 1928. Ibidem	Ochotona h. cinereo-flava. Average
Length of skull	36.2	39.5	40.7	39.3	37.3	41	39.9	41.1	38.2	39.6	40.0	42	40	40	41	40.8
Basal length of skull	29.2	d.	33.1	31.1	29.6	33.2	32.2	33	31.1	32.1	32.3	33.2	33	31.7	d.	32.6
Condylobasal length	34	d.	38.3	36.8	34.4	38.6	37	37.5	36	36.3	37.0	39.2	38	37.2	d.	38.1
Length of nasals	9.9	12.1	11.7	11.7	11.0	11.8	12.1	11.3	11.1	12.2	11.7	14	12.2	12	12.8	12.8
Zygomatic width	18.2	19.6	20.7	19.3	18.5	20.6	19.3	20	19.8	19.8	19.9	20.7	20.3	20	20.3	20.3
Interorbital space	4.9	4.3	5.7	4.9	5.0	5.6	5.1	5.2	5.2	5.1	5.2	5	4.9	5.2	5.2	5.1
Width of skull posterior to zygomatic arches	12.3	13.2	13.2	13.2	12.7	14	13.2	14.5	14.2	13.2	13.8	13.3	14.2	13.2	14	13.9
Width at level of auditory apertures	18.3	d.	21.3	20	18.5	21.2	19.3	19.9	19.	—	19.8	19.6	19.4	19.2	18.1	19.1
Length of facial area	15.6	16.7	17.8	17.7	16.3	18	17.8	18.1	17.2	18	17.8	18.9	18.2	17.6	18.1	18.2
Length of braincase	18.3	d.	20.1	19.2	17.7	19	18.9	19.9	18.8	18.2	19.0	20.2	19.8	19.2	—	19.7
Length of frontal suture	10.3	12.7	13.7	12	11.1	12.3	13	13	12.8	12.9	12.8	13.2	13.1	12.5	12.7	12.9
Height of occipital area	8.8	d.	10.1	9.9	9.5	11.1	10.2	11.1	10.1	10.7	10.6	9.8	9.7	9.6	d.	9.7
Length of bullae osseae	11.8	d.	13.2	12.3	11.3	12.2	12.2	12.3	11.2	d.	12.0	13.1	12.1	12	d.	12.4
Width of bullae osseae	8.1	d.	9.8	9.1	8.3	9	8.5	8.8	7.9	8.9	8.6	8.3	8.1	8.1	d.	8.2
Length of palatine foramen	4.6	6.6	6.5	5	4.9	6	5.5	5.1	6	5.1	5.5	6.1	5.7	5.2	5.9	5.7
Diastema	7.2	8.2	8.1	7.3	7.0	8.1	7.9	8	8.1	8.4	8.1	7.5	7.5	8	8.8	8.0
Length of upper tooth row	6.7	7.1	7.6	8	6.7	7.3	7.3	7.3	7.2	7.2	7.3	7.6	7.3	7.3	7.6	7.4
Length of mandible	23.2	25.2	25.8	24.9	23.6	26.7	24.3	26	24.1	24.3	25.1	26.3	25.3	25.6	26.1	25.8
Height of mandible	13.8	15	16.3	15.2	13.5	15.7	14.9	15	14	14	14.7	15.7	15.2	15	15	15.2
Body length	—	—	—	—	140.8	—	—	—	—	—	—	162	161	139	144	151.5
Length of feet	—	—	—	—	21.8	—	—	—	—	—	—	28	25	26	27.2	26.6
Length of ears	—	—	—	—	13.2	—	—	—	—	—	—	21.5	18.5	23.2	24.8	22.0

TABLE 7

Measurements of the northern pika Ochotona hyperborea Pall.

Subspecies	Ochotona h. uralensis Flerov				Ochotona hyperborea mantchurica Thos.												
	No. 16107 ♀ 10 Aug. 1926. Eastern slope of the Urals, valley of Kharuta river (Syr'i). K. K. Flerov	No. 16110 ♂ 17 Aug. 1926. Ibidem. ZMAN collection	No. 16111 ♀ 16 Aug. 1926. Northern Urals. K. K. Flerov	Ochotona h. uralensis. Average	No. 594 (246) ♀ 16 July 1928. Kyker village, Yablonovyi Range. B. A. Kuznetsov	No. 602 (272) ♀ 17 July 1928. Ibidem	No. 595 (313) ♀ 20 July 1928. Ibidem	No. 599 (350) ♂ 2 July 1928. Ibidem	No. 593 (245) ♀ 16 July 1928. Ibidem	No. 596 (314) ♂ 20 July 1928. Ibidem	No. 598 (349) ♂ 23 July 1928. Ibidem	No. M.3445 Sep. 1930. Gazimur village, Transbaikalia	No. 337, 9 Aug. 1925. Bal'zino, Chita District, Alkhanoi Mountain. Vinogradov and Obolenskii	No. 354, 10 Aug. 1925. Ibidem	No. 334, 9 Aug. 1925. Ibidem	♂ ad. 31 Aug. 1932. De Kastri Bay, Tatar Strait	No. M.3993 ♂ ad. 1 Oct. 1932. Ibidem
Length of skull	39.1	37.1	37.8	38.0	40.4	41.4	39.4	40.3	39.9	40.4	40.1	39.9	42.1	42	41	39.3	41
Basal length of skull	d.	31.2	30.3	30.8	32.4	34.3	32.8	30.9	32.3	33.3	33	31.8	34.2	33.3	32.6	31.6	33.7
Condylobasal length	36.6	36.3	35.3	36.1	37.2	39.3	36.7	36.7	36.8	37.4	37.9	37	38.6	39.2	38.3	37	37.7
Length of nasals	12.5	11.7	12	12.1	11.8	13.1	11.7	12.3	11.9	11.7	12.6	12.3	12.1	12.3	12.1	11.6	12.2
Zygomatic width	20.1	18.5	19.4	19.3	19.8	20.8	19.6	19.8	20	19.8	20	20	21	21.2	20.2	20	21
Interorbital space	5	5.1	5.3	5.1	4.4	4.3	4.8	4.7	4.9	4.8	4.8	5	5	5	4.8	4.8	5.1
Width of skull posterior to zygomatic arches	12.9	12.2	13	12.7	13	14	13	13.1	13	13.8	13.3	13.3	14.2	13.1	13.2	13.5	12.2
Width at level of auditory apertures	19.7	d.	18.8	19.2	20.3	21	19.3	20.3	20.1	20	20.1	19.6	21.1	21.1	20.6	19.2	d.
Length of facial area	17.2	16.3	16.3	16.6	17.3	18.9	17.9	17.2	17.7	18.8	18	18.3	18	19	19.1	18	18
Length of braincase	18.9	19.8	19.2	19.3	19.1	20.1	18.6	18.2	19.2	20.1	20	18.2	19	20.1	20.2	20.2	21.2
Length of frontal suture	12	11.8	12.1	12.0	13	13	12.2	12.1	12.9	13	12.7	12.5	14.6	14	13.7	12.6	11.3
Height of occipital area	9.6	9.8	9.1	9.5	10.2	10.9	10	10.2	10.1	10.2	10.1	10.9	10.5	10.3	10.6	10.2	10.1
Length of bullae osseae	11.9	d.	11.9	11.9	12.2	12.7	12	d.	11.8	11.9	12.2	11.1	12.3	12.2	12.6	12.3	12.1
Width of bullae osseae	9	d.	8.4	8.7	9	9	9.1	d.	9.6	9.1	8.8	9	9	9	8.9	8.2	8.3
Length of palatine foramen	5	d.	5.2	5.1	5	5.3	5.9	5.2	5.1	5	6	6	6.1	6.2	5	4.7	5
Diastema	7.6	7.3	7.2	7.4	8	8.2	7	7.5	7.7	8.2	7.7	8	8.2	8.3	9	7.9	8.1
Length of upper tooth row	7.5	7.3	7.1	7.3	7.1	7.9	7	7.2	7.3	8	7.3	7.7	7.3	7.8	7.9	7.1	7.2
Length of mandible	25.3	23.3	24	24.2	26	26.2	25.2	d.	26	26.6	25.2	25.7	27.1	26.8	26.3	d.	d.
Height of mandible	15.2	14.5	14.2	14.6	15.2	16	15.3	d.	16.1	16	15	15	16.3	16.1	16.1	d.	17
Body length	168	183	—	175.5	175	182	176	165	172	169	172	—	163	177	162	167	195
Length of feet	22.5	27	—	24.8	25	27	25	25	27	25	26.4	—	24.2	26.3	23.7	20.2	—
Length of ears	17.5	18.5	—	18.0	17	20	20	20	18	19	17.6	—	21.5	21	24	19	20

TABLE 8

Measurements of Ochotona hyperborea Pall., Ochotona daurica Pall. and Ochotona rufescens Gray

Subspecies	Ochotona mantchurica Thos.				Ochotona daurica daurica Pall.					Ochotona d. altaina Thos.					Ochotona rufescens regina Thos.					
	No. M.4519, 30 Nov. 1935. Krasnoyarsk, beyond Bazaikha River. D. B. Krasovskii	No. 19, ♂ 28 Sep. 1933. Eastern slopes of Great Khingan. A. Lukashkin	No. 18, ♀ 28 Nov. 1933. The Yalu station of the Chinese Eastern Railway, eastern slope of Great Khingan	Ochotona h. mantchurica. Average	No. M.3997, ♂ ad. 12 June 1925. Borzya village, Transbaikal	No. M.1762, 21 Oct. 1924. Upper reaches of the Kyakhta River, vicinity of Troitskosavsk [Kyakhta] P. S. Mikhno	No. M.3304, Apr. 1904. Vicinity of Troitskosavsk [Kyakhta]. P. S. Mikhno	No. 604 (470), ♀ 9 Aug. 1928. Tsagan Nor. B. A. Kuznetsov	No. M.4520. 17 May 1935. Dalai Nor Lake. A. S. Lukashkin	No. M.4352, ♂ 28 July 1934. Floodland of Sorovu River, 4 km from Toshakty. S. I. Ognev's collection	No. 64, ♀ 5 July 1936. Altai, Chuya Alps, Chegan Burgazy River (2000 m). A. Kolosov	No. 122, ♂ 9 July 1936. Ibidem	Ochotona daurica daurica. Average	Ochotona daurica altaina. Average	No. 4020 (229), ♂ sen. 23 June 1925. Germet, Kopet Dagh. S. I. Ognev's collection	No. M.4015 (211), ♂ 21 June, 1925. Ibidem	No. M.4016 (254), ♂ sen. 30 June 1925. Kurkulab, Kopet Dagh	No. M.4018 (218), ♂ 22 June 1925. Ibidem	Ochotona rufescens regina Thos. After Thomas	Ochotona rufescens regina Thos. Average
Length of skull	43.3	41.9	43.2	41.0	43.7	43	43.9	38.5	42.9	47	44	46.7	42.4	45.9	51.1	53.2	47.9	47.7	51.5	50.3
Basal length of skull	35	33.2	34	33.0	34.2	34.1	34.6	32	33.4	38.5	35	37	33.7	36.8	41.5	44.5	39	37.5	—	40.6
Condylobasal length	40.2	38.8	40.1	38.0	41	40.2	40.9	36.3	39.6	45.2	40.7	44	39.6	43.3	47.5	48.7	44.5	43.3	48.4	46.4
Length of nasals	13.8	12.7	13	12.3	14.7	14.8	13.6	13.3	15	15.5	15.5	15.6	14.3	15.6	16.3	16.2	17.8	15.5	—	16.4
Zygomatic width	20.1	20.9	20.8	20.3	20.5	21.1	21.1	20.4	d.	23	21.7	22	20.8	22.2	24.9	24.3	23	23.2	25	23.8
Interorbital space	5	5	5	4.8	4.2	3.7	3.2	4	3.9	4	4.2	4.1	3.8	4.1	3.8	3.1	3	3.8	3.2	3.4
Width of skull posterior to zygomatic arches	14.2	13	13.3	13.3	13	13.2	13.5	13.2	14	14.2	14.1	14.2	13.4	14.2	15.3	14.8	13.6	15.2	—	14.7
Width at level of auditory apertures	21	19.2	21.1	20.3	20.2	20.2	20.1	19.2	20.2	21.5	21	21.2	20.0	21.2	23.2	23.2	22	22.8	—	22.8
Length of facial area	19	19.1	19.1	18.3	20.1	19	19.8	17.3	19.2	21.3	20.2	20.6	19.1	20.7	23.2	25.[?]	22.1	21.3	—	23.0
Length of braincase	21.1	19.6	19.2	19.6	20.6	21	20	18	19.8	22.2	20.3	22.3	19.9	21.6	23	23.8	22	21.2	—	22.5
Length of frontal suture	13	13.2	14.2	13.0	12.9	13.2	d.	11.3	12.1	14.1	12.7	13.7	12.4	13.5	16.1	16.2	17	17.2	—	16.6
Height of occipital area	10.9	10.8	10.2	10.4	10.2	10.2	10.2	9.5	10.1	11.3	10.2	11	10.0	10.8	10.6	12	11.1	12.3	—	11.5
Length of bullae osseae	12.5	11.7	12.3	12.1	12	13	13	12	12.3	13.5	12.7	13.6	12.5	13.3	16	14.2	13.8	13.3	—	14.3
Width of bullae osseae	10.2	8.3	9	9.0	9	8.8	9.2	9.1	9.2	9.6	9	9.3	9.1	9.3	10.8	9.9	9.8	9.2	—	9.9
Length of palatine foramen	6.5	6.8	6.2	5.1	11.2	11	11.2	9.1	11.2	11.3	12	12.2	10.7	11.8	15	14.2	13.4	13.2	15.5	14.3
Diastema	7.3	8	8.8	8.0	8.5	7.7	8	6.6	8.6	9.3	9.7	9.4	7.9	9.4	10.1	10.1	9	9.3	—	9.6
Length of upper tooth row	7	7.2	7.2	7.4	8.1	8.3	8.6	7.7	8	8.8	8.3	8.6	8.1	8.6	9.9	9.7	9.4	9	—	9.5
Length of mandible	28.3	27.2	28	26.5	28.3	30.2	29.1	24.3	29	30.2	28.2	31.1	28.2	29.8	34.5	35.2	31	32	—	33.2
Height of mandible	16.1	15.3	15.6	15.8	16.5	17.3	16.9	15.9	16.1	17.5	16.5	17.7	16.5	17.2	20	21	18.6	18.2	—	19.4
Body length	150	194	—	172.8	175	—	—	176	—	195	195	185	175.5	191.7	219	207	205	189	—	205.0
Length of feet	30	26	—	24.9	27	—	—	27	—	29	31	29	27.0	29.7	36	35.2	34	32.8	—	34.5
Length of ears	21	18	—	19.7	21	—	—	20	—	25	22	21	20.5	23.7	23	23	21	21	—	22.0
											weight 190 g									

In Ochotona daurica the palatine and incisive foramina are fused.

TABLE 9

Measurements of Ochotona pricei Thos., Ochotona rutila Severtz. and Ochotona macrotis Günther

Subspecies	Ochotona pricei pricei Thos.									Ochotona pricei subsp. nov.			Ochotona rutila rutila Severtz.									Ochotona macrotis Günther			
	No. 212 ♂ 7 Sep. 1926. Mongolia, Dzabhan Gol river, at its source in the mountain. A.N.Formozov	No. 190 ♀ 1 Sep. 1926. Mongolia, 350 km west of a mountain pass in the Baidarik Mountain. A.N.Formozov	No. 165 ♂ 23 Aug. 1926. Gobi Altai, Yihe Bogdo. A.N.Formozov	No. 93 ♀ 1 Aug. 1926. Lower reaches of the Tuin Gol river. A.N.Formozov	No. M.3974 ♂ 10 Sep. 1926. Mongolia, 100 km north of Uliassutai [Tibhalanta]	No. 459, 20 June 1926. Mongolia. P.K.Kozlov	No. 2939 ♀ 6 Feb. 1841. Chuya river. Eversman. ZMAN collection	No. 2988, 26 Jan. 1841. Chuya river. Romanov	Ochotona pricei pricei Thos. Average	No. 17422, 18 Oct. 1926. Karkaralinsk County, Kenishev settlement. Ul'yashevich	No. 19987 ♂ subad. 21 July 1928. Karkaralinsk County, Kedeiskaya Subdistrict. Belyaev	Ochotona pricei subsp. Average	No. 23149, 19 Sep. 1932. Pyandzh river, near village Shid. ZMAN collection	No. 2595 ♂ 15 Aug. 1878. Iskander Kul. Russov. ZMAN collection	No. 83, 22 June 1892. Iskander Kul. D.K.Glazunov. ZMAN collection	No. 87, 3 July 1892. Ibidem	No. 20302, ·1928. Pamir, Germano-Russian expedition. ZMAN collection	♂ 1929. Kok Mainok, Alexander Range. ZMMU collection	♀ 22 May 1929. Issygatinskaya wood lot, Alexander Range. ZMMU collection	24 Aug. 1929. Ibidem	Ochotona rutila. Average	No. 20299, 1928. Pamir, Germano-Russian expedition. ZMAN collection	No. 22563, 5 Aug. 1932. Kizil Rabad, M.P.Rozanov. ZMAN collection	No. 6997, 21 Sep. 1873. F.Stoliczka, ZMAN collection	Ochotona macrotis. Average
Length of skull	47.2	46.6	45.9	48	45	47.8	46.3	48	46.8	46	44.1	45.0	50.2	50.2	48	47.6	49.7	50.8	50	50	49.6	45	43.8	45.6	44.8
Basal length of skull	d.	38	37	36	35.3	37.2	37.8	39	37.2	38	34.3	37.0	39.3	40.3	38.1	38.3	40.1	40.3	39.2	41.3	39.6	36	33.3	d.	34.6
Condylobasal length of skull	d.	43	43	43.2	41.2	43	43.3	44.2	43.0	43.2	40.6	37.2	46.7	47.2	44.6	45	46.1	47.3	45.2	47.2	46.2	42.1	40.6	d.	41.4
Length of nasals	16	15.2	15.2	16.9	14.6	15.9	15.1	16.2	15.6	15.2	14.5	14.8	17.1	17.1	16.1	16	16.9	17.5	d.	17	16.8	15.3	14.5	16.1	15.3
Zygomatic width	23.1	d.	22.6	d.	22.2	23.8	23.1	24	23.1	23	22.3	22.6	23.2	23.3	23.2	23.8	23	24	24	d.	23.5	22.3	d.	22.2	22.2
Interorbital space	4.3	4.7	4.2	4.1	4.2	4.2	3.5	4	4.2	4	4.6	4.3	6.1	6	6.9	6.8	6.1	6.2	6	d.	6.3	6	6	5.2	5.7
Width of skull posterior to zygomatic arches	15.2	d.	15.2	14.2	14.2	16.1	13.9	15.2	14.8	d.	14.6	14.6	16.3	16.1	16.4	16.3	15.6	16.3	16.2	17.3	16.3	16	15.1	15.9	15.7
Width at level of auditory apertures	22.9	24.1	23.6	22	22.3	24	23.1	23.3	23.2	d.	22.1	22.1	23.2	24	d.	23	23	23.8	23.7	23.2	23.4	22.8	d.	d.	22.8
Length of facial area	21.2	22	21	22	20.3	22.2	22.1	22.5	21.7	21.4	19.2	20.3	23.9	22.7	21.2	22.1	23	22.2	22.3	23.7	22.6	19.9	20	21.1	20.3
Length of braincase	d.	20.2	21.7	21.2	20.2	21.2	21.5	21.4	21.0	d.	20.6	20.6	22.3	22.6	22.6	23.2	22.2	23.6	21.8	23	22.7	21.7	19.9	d.	20.8
Length of frontal suture	15.3	d.	14.3	16	15	17	15.2	15.9	15.5	d.	15	15.0	15	15.6	14	15.2	14.9	15.2	17.2	d.	15.3	14	14.9	14.6	14.5
Height of occipital area	d.	11.5	12	11.1	11	11.2	11.8	11.3	11.4	d.	12.2	12.2	12.3	12.1	12	11.9	12.3	12.2	12.3	12.3	12.2	12	12.6	d.	12.3
Length of bullae osseae	13.6	13.8	13.2	13.7	13.3	14.2	14.8	14.1	13.8	d.	13.3	13.3	13	14.1	13.2	13.3	13.6	15.3	13.7	13.5	13.7	13.1	d.	d.	13.1
Width of bullae osseae	10.3	9.8	10.3	10	9.1	10.8	10.2	11.2	10.2	11.2	10	10.6	9.2	11	9.3	10.2	10.6	11.3	9.4	10.3	10.2	11	10	d.	10.5
Length of palatine foramen	7	8.2	7.2	8.6	6.1	7.9	8.5	7	7.6	8	7.2	7.6	14.2	13.2	12.2	11.9	14	14	13.3	13.8	13.3	12	d.	12.3	12.2
Diastema	9.3	10.2	9.2	9.9	9.5	10.2	9.2	10.5	9.8	9.2	8.9	9.0	11.1	10.5	10	9.6	10.2	10.6	10.5	10.9	10.4	9.3	8.2	10.7	9.4
Length of upper tooth row	9.1	8.8	8.9	9	8.5	9	9.9	9.2	9.0	9.2	8.2	8.7	10	9	8.9	8.9	9.3	9.1	9.4	9.3	9.2	8.9	8.8	8.9	8.9
Length of mandible	30.9	29.9	30.7	29.1	29.3	31	30.5	32	30.4	30.2	29	29.6	32	33	32.3	30.7	32.2	35.3	34	33.4	32.9	29.3	29.3	29	29.2
Height of mandible	18.2	18.3	d.	17.1	17.2	19	18.3	18.6	18.1	18.3	18.2	18.2	19.2	19.9	18.2	19	18.3	19.8	19	18.7	19.0	17.3	18	17.9	17.7
Body length	183	197	197	—	179	—	—	—	189.0	—	—	—	230	—	—	—	—	—	—	—	230.0	—	192.4	—	192.4
Length of feet	31	31.5	33	—	30	—	—	—	31.4	—	—	—	35.5	—	—	—	—	—	—	—	35.5	—	32.2	—	32.2
Length of ears	27	23.5	23	—	21	—	—	—	22.9	—	—	—	27	—	—	—	—	—	—	—	27.0	—	31	—	31.0

TABLE 10

Measurements of Ochotona pusilla Pall.

Subspecies	Ochotona pusilla pusilla Pall.						Ochotona pusilla angustifrons Argyrop.								
	No. M.3725 ♀ 19 July 1926. Saverovo, near Orsk. B. A. Kuznetsov	No. 144 ♀ 29 July 1926. Ibidem	No. 191 ♂ 1 Aug. 1926. Ibidem	No. S.4279, 15 Oct. 1909. Polibino, Buguruslan County. A. N. Karamgin	No. 25 ♀ 22 Aug. 1934. Bashkiria, 30 km north of Kuvandyk railway station, southern Urals. S. V. Kirikov	Ochotona pusilla pusilla Pall. Average	No. 2347 ♀ 6 June 1929. Semipalatinsk Region, Sergiopol [Ayaguz] District, Znamenka Village. B. A. Kuznetsov	No. 2344 ♀ 5 June 1929. Ibidem	No. 2341 ♀ 3 June 1929. Ibidem	No. 2350 ♀ 8 June 1929. Ibidem	No. 2349 ♂ 8 June 1929. Ibidem	No. 2348 ♀ 6 June 1929. Ibidem	No. 2338 ♂ 2 June 1929. Ibidem	No. 17421. Karkaralinsk, Dzhamcha river, former Kedeiskaya subdistrict. Filatov	Ochotona pusilla angustifrons Argyrop. Average
Length of skull	35.6	38.7	36.4	35.7	38.3	36.9	41.2	39.7	40	41.6	40.3	30	41.5	43.2	40.9
Basal length of skull	29.2	31.9	29.4	29	31	30.1	34	32.5	31.2	33	33	32	32.6	34.3	32.8
Condylobasal length of skull	32.8	36.7	32.4	34.2	36	34.4	38.7	37.7	37.7	38.3	38	37.2	38.2	40.2	38.2
Length of nasals	10.6	13	d.	10.5	12.5	11.6	14.1	13.7	13.7	14	12.4	12.2	d.	14	13.4
Zygomatic width	18.6	19	18.4	18.6	19.1	18.7	21.2	19.7	18.9	19.8	20.8	20	20	22.3	20.3
Interorbital space	5	4.2	4.2	5	4.3	4.5	4.2	4.2	4.3	4.2	4.2	4.8	4.6	3.6	4.3
Width of skull posterior to zygomatic arches	13	12.1	12.7	12.2	13.2	12.6	13.3	12.2	12.8	13	13	13	13	15	13.2
Width at level of auditory apertures	d.	19.8	d.	18.1	18.9	18.9	21.3	20.1	20	20.6	21	20.5	d.	22.2	20.8
Length of facial area	14.2	18	16	16.1	16.7	16.2	18	18	18.1	18.5	18.7	17.8	19	21	18.6
Length of braincase	17.6	18.5	16.7	17.9	18.8	17.9	20	19.8	17.9	19.6	20.1	19	18.5	20	19.4
Length of frontal suture	11.1	11.3	11.5	12	12.2	11.6	12.7	12	12.3	12.6	12.6	12	12.9	13.8	12.6
Height of occipital area	10	9.8	9.4	9.6	10	9.8	11	10.7	10	11	10.8	10	10	11.3	10.6
Length of bullae osseae	10.7	11.6	11.1	10.3	12	11.1	13	12.3	12.3	13	12.8	12	12.6	13.2	12.6
Width of bullae osseae	7.3	8.2	9.2	8.1	9	8.4	9	9.3	9.6	10	9.6	9.3	9	9.7	9.4
Length of palatine foramen	6.7	9.7	8.3	9.2	8.3	8.4	9.8	9.2	8.9	9.2	9.1	8.8	9	12.3	9.5
Diastema	5.7	6.5	6	6.3	7	6.3	7.2	6.9	7.1	6.7	7	6.9	6.9	9.1	7.2
Length of upper tooth row	6.9	7.3	6.9	7.3	7.2	7.1	8.2	8.3	8.2	8.5	8	7.8	8.3	8.8	8.3
Length of mandible	22.3	26.3	24.1	24.2	26.1	24.6	27.2	25.7	25.3	25.3	26	25	27	28	26.2
Height of mandible	13.8	15	15	15	15.2	14.8	17.2	16.3	15.4	16.2	16.7	16	16.9	18.2	16.6
Body length	164	182	153	—	170	167.2	198	196	185	194	196	191	182	—	—
Length of feet	27	27.5	26.2	—	26.1	26.7	27	27	26	28	28	27	30	—	—
Length of ears	11.2	15.6	15.2	—	14.8	14.2	17	20	17	19	19	16	19	—	—
															Typus!

TABLE 11

Measurements of Lepus europaeus Pall.

Subspecies	Lepus europaeus europaeus Pall.			Transitional between L. e. europaeus Pall. L. e. hybridus Desm.					Lepus e. hybridus Desm.											
	No. S. 2815 sex.*Feb. 1912. Vicinity of Halle, on the Saale. Schluter ZMMU collection	No. M.4488, ♂29 Nov. 1930, Kr. Grouthin, Prov. Sachsen Deutschland, Prof. Dr. C. Zimmer, S.I. Ognev's collection	No. 4487, ♀ 29 Dec. 1930, Ibidem	No. M.3023, ♀ 17 Oct. 1912. Near Novaya Aleksandriya [Pulawy] Lyublin Province. Prof. Tamani	No. M.3015, ♂10 Jan. 1915. Pochapintsy, Kiev Province. P. A. Portenko	No. S.4742 Chigirin County, Kiev Province Krementskii ZMMU collection	L. europaeus europaeus Pall. Average	Transitional between L. e. europaeus Pall. and L. e. hybridus Desm. Average measurements	No. M.3014, 5 Oct. 1914. Moscow Province, Bogorodsk [Noginsk] County. S. I. Ognev's collection	No. S.1706, ♀sen. 20 Jan. 1908. Dyatlovka Village, Bogorodsk [Noginsk] County, Moscow Province. G. I. Polyakov	No. S.2059, ♂14 Oct. 1910. Motyakovo, Moscow County. G. I. Polyakov	No. S.2297, ♂8 Sep. 1910. Bogorodsk [Noginsk] County, Moscow Province. G. I. Polyakov	No. S.2042, ♀12 Dec. 1910. Forests of the Moscow Agricultural Institute. Andreev	No. S.1387, ♀ 26 Oct. 1908. Bogorodsk [Noginsk] County, Moscow Province. M. M. Kemer	No. S.2541, ♂30 Mar. 1911. Petrovskoe-Razumovskoe, near Moscow. Andreev	No. S.2046, ♂5 Feb. 1889. Moscow County. F. K. Lorents	No. S.2131, Oct. 1909. Bogorodsk [Noginsk] County. Moscow Province. G. A. Kozhevnikov	No. S.2832, 22 Nov. 1913. Ibidem. G. A. Kozhevnikov	No. S.3075, 1910. Luga County, Petersburg Province, Knyazhitskaya wood lot	No. S.3085, 13 Feb. 1916. Novosil' County, Tula Province. F. S. Shcherbakov
Length of skull	98	95.2	99.8	102.2	106	107	97.7	105.1	99.8	106	100.7	102.2	99.3	102	103.5	99.4	101.4	104.5	101	101.6
Basal length of skull	75.2	73.9	76.7	78	81.6	d.	75.3	79.8	79	82.7	79.8	79	78.5	80	83.2	78	80.3	81.3	80.4	79.2
Condylobasal length of skull	87.7	84	87.6	91.8	93.3	95	86.4	93.4	91.2	97	92	91	90.2	91.2	94.2	89.1	92.8	93.5	92.2	91.2
Zygomatic width	45.6	44.6	48	48.8	51	52	46.1	50.6	47.5	51.2	47.5	48.5	47.6	48	50.6	46.9	49	48.8	48.3	48.2
Length of nasals	44	42.3	47	d.	47	52	44.4	49.5	44.3	48.4	46.1	49.3	47	49.3	47.1	47.8	47.5	47.5	46.8	48
Width of nasals	17.3	16.2	17.2	18.2	19	23	16.9	20.1	18.3	21.1	21	20.7	17.9	19.2	20.2	15.8	19.1	19	18.6	20
Width of nasal foramen	12.7	12.6	13.6	13	14.1	16.1	13.0	14.4	15.1	17	16	16.1	14	13.9	15.2	12.6	14.7	14.9	14.2	15.1
Width of level of auditory apertures	35	34.2	d.	38.1	38.1	d.	34.6	38.1	36.7	40.2	38.9	36.1	38.6	37.7	37.3	36.8	38	38.5	38.6	38
Lateral length of braincase**	36	31.5	31.4	37.8	37.2	39.5	33.0	38.2	34.2	39.8	36.3	36.2	37.7	38.3	37.5	37.7	36.2	37.3	36	37
Lateral length of facial part of skull	43.2	41.5	44	44	45.8	48	42.9	45.9	44	47	45	45.2	45	45.8	48	45	46.8	47.6	45.5	45.3
Length of bony palate	6.1	6.4	6.1	7	8	6.5	6.2	7.2	6.2	6.2	7.2	6	7.2	5.3	7.1	7.1	7.2	6.5	6.6	7
Width of incisive foramina	12	11	11.2	11.9	10.8	14	11.4	12.2	10.8	12.3	11	11	12.7	12.2	11.5	11.1	12	11.7	13.5	12.2
Length of incisive foramina	25	26	26.7	26	27.1	28.2	25.9	25.1	27.6	28.2	26.2	26	27.6	27	29.1	26.1	30	28	27	29
Length of zygomatic arch	40.1	35.3	39.8	40.5	40.9	d.	38.4	40.7	39.9	42.2	41.1	41.2	39	40	41.8	38.1	42.1	42	39.3	41.8
Length of upper tooth row	17	17.5	17.6	18.5	18.3	19.6	17.4	18.8	17.8	20.2	18.9	18.1	18.6	20	19.8	18.3	17.1	19.2	18	18.1
Upper diastema	29	29.8	29	29.5	30.2	32	29.3	30.6	30.1	32.1	29	28	30	30.2	33.1	28.7	31.5	31	30.3	30
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* [The word "sex" in the tables probably means sex undetermined (sex?); the question mark has apparently been omitted in the Russian text.]

** From inion to posterior base of zygomatic process of temporal bone.

TABLE 12

Measurements of Lepus europaeus Pall.

Subspecies	L. e. hybridus Desm.			Lapus europaeus tesquorum Ogn.														
	No. 2181 ♀ Jan. 1911. Kuznetsk County, Saratov Province. N. F. Ikonnikov	No. 2182 ♀ Jan. 1911. Ibidem	L. e. hybridus. Average	No. M. 2880 sex. 17 Dec. 1926. Kamennaya Steppe, Bobrov County, Voronezh Province. A. I. Mal'tsev	No. M. 1982, May 1922. Ibidem. S. I. Ognev's collection	No. 2986 ♂ 17 June 1922. Ibidem. A. I. Yurin	No. M. 2981 ♂ 19 July 1921. Ibidem. A. I. Mal'tsev	No. M. 2994, 1921. Ibidem	No. M. 2976 ♂ Feb. 1921. Ibidem	No. M. 2996, 1921. Ibidem	No. 2992 ♂ 6 June 1921. Ibidem	No. M. 2977 ♀ 27 Oct. 1921. Novyi Kurlak Village, Bobrov County, Voronezh Province	No. M. 2995, 3 Dec. 1921. Kamennaya Steppe, Bobrov County, Voronezh Province	No. M. 2988 ♂ 22 July 1921. Ibidem	No. M. 2978, 17 Dec. 1921. Ibidem	No. 3002, 1921. Ibidem	No. M. 2997, 4 Dec. 1921. Ibidem	No. M. 2987, 1922. Ibidem
Length of skull	102.2	102.6	101.9	108.5	104	104.7	105.3	103.6	105	104.2	103.5	100.3	99.8	103	104	103.6	100.3	101.5
Basal length of skull	77.1	77.8	79.7	82.9	80.2	80.2	81.3	81	82	80.5	79.5	77	77.9	81.1	81.2	78.6	77.2	80.3
Condylobasal length of skull	90.3	90.2	91.9	97.5	92.8	93.4	95	92	94.2	91.8	93.1	89.6	90.5	92.3	93.3	91.2	88.3	92
Zygomatic width	48.3	49.2	48.5	54	51.2	50.5	48	49	49	49.3	50	47.4	50.2	50	48.7	d.	49	48
Length of nasals	49	47	47.5	50.9	49.2	50	49.9	48.8	48	49.7	48.8	46	46.5	47.2	50.7	49.8	45.6	47.3
Width of nasals	19	18.5	19.2	23.6	19	21	20.2	20.2	22	21.2	23.6	20	21.1	21.2	21.2	17.3	19.8	19
Width of nasal foramen	14.2	14.2	14.8	14.3	16.2	17	15.2	14.1	16.2	15	15.2	15	16.1	17.2	15.8	12.9	14	14.6
Width at level of auditory apertures	36.2	39.3	37.9	d.	38.1	39.9	38.5	37.2	39.2	39.5	38	37	38	39	38	37.3	38	d.
Lateral length of braincase	36.3	37	37.0	38.9	36.2	35	37	36.2	40.1	38	37	38.1	35	37.6	36.7	36.3	37	37.5
Lateral length of facial part of skull	45	41	45.4	50	46	48.2	48	46	47.2	46.8	46.3	44.8	45	45.2	42.7	47.3	45	46.6
Length of bony palate	7	6.1	6.6	7	7.6	6.1	6.1	6.9	7.6	6.1	6.2	7.1	7.2	5.6	6.3	7	7.2	6.3
Width of incisive foramina	11.1	12.6	11.8	15.2	12.2	11.1	12.1	12	11.6	12.6	13.2	11.2	12.9	15	11.5	11.2	12.1	13.2
Length of incisive foramina	—	—	27.6	30.2	27.6	28.2	28.3	28	27.2	28.6	28.2	26	28.3	28.1	27.8	27	27.5	27.6
Length of zygomatic arch	41.1	40	40.7	42.2	42.2	40.1	40.2	41.2	40.9	41.5	42	37.7	41.2	40.3	41.6	40.2	39.1	38.2
Length of upper tooth row	—	18	18.6	20.7	20	18.8	18.7	18.2	19.3	17.1	18.2	17.7	17	20	17.7	16.8	18	17.6
Upper diastema	29	30.3	30.2	32	30	31	30.6	30.2	29.8	32.2	29.8	28.6	30	29.3	31.7	31	30	31
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 13

Measurements of Lepus europaeus Pall.

Subspecies	Lepus europaeus tesquorum Ogn.																			
	No.M.2990, ♂ 17 Dec. 1921. Kamennaya Steppe, Bobrov County, Voronezh Province. S.I. Ognev's collection	No.M.3004, Jan. 1910. Lebedki Village, Orel County, Orel Province S.N. Gorbachev	No.M.3003, Jan. 1910. Sen'kovo Village, Orel County, Orel Province. S.N. Gorbachev	No.M.3008, Jan. 1910. Ibidem	No.M.2939, Jan. 1910. Sen'kovo Village, Orel County, Orel Province	No.M.3026, 8 Jan. 1923. Kozlov County, Tambov Province. K.K. Flerov	No.S.3102, 27 Sep. 1915. Vol'sk County, Saratov Province. Kindyakov	No.S.2044, start Dec. 1909. Tsarevshchinskaya Subdistrict, Vol'sk County, Saratov Province	No.S.2045, start Dec. 1909. Ibidem	No.S.2863, 18 Nov. 1913. Ters Village, Saratov County, Saratov Province	No.S.2034, 2-3 Jan. 1911. Shipovskoe forestry, Porzovskaya Subdistrict, Petrovsk County, Saratov Province. Kindyakov	No.S.2670, 8 Nov. 1912. Vol'sk County, Saratov Province	No.S.4967, 28 Dec. 1915. Verstanovka, Sumy County, Kharkov Province. A. Migulin	No.S.2402, Dec. 1911. Petrovsk County, Saratov Province. Kindyakov	No.S.3033, 4 Oct. 1915. Lipets County, Tambov Province. G.A. Kozhevnikov	No.S.4968, 10 Jan. 1923. Kozlov County, Tambov Province	No.S.3345, 19 Nov. 1915. Gorlovo, Skopin County, Ryazan Province. S.S. Turov	No.S.3341 19 Nov. 1915. Ibidem	Lepus e. tesquorum Ogn. Average
Length of skull	100	101,1	104,2	100,9	99,2	100,2	107	103	103	105,2	97	104,3	103,3	105,7	99,2	100,7	102	106,5	102,8
Basal length of skull	76	80	81	78	76	76,6	82,7	80,7	79,6	81,8	74,2	81	82,1	81,6	75,2	78,5	78	82,9	79,6
Condylobasal length of skull	87,2	91,1	93	90	87	89,2	97	93	91,8	94,2	96,3	94	92	94,3	88,2	90,2	90	96	92,2
Zygomatic width	49,2	50	48,8	48	46,2	49	52	49,3	46	50,7	d.	49,3	50,6	48,2	48,8	48,3	d.	47,7	49,2
Length of nasals	48,9	46,7	46,8	47,3	46	47,6	50,1	45,3	48	48	43,2	47,3	47,3	47,2	47	46,5	48,7	49,5	47,8
Width of nasals	18,2	19,2	18,7	20	19,1	21,8	20	19,1	19	22,2	17,2	20	21,1	19,5	20,7	18	18,3	19,9	20,1
Width of nasal foramen	14,2	14,7	13,5	14,3	15	15,1	15,2	15,2	14	16,8	13	15	14,1	15,5	16,5	13,3	14,3	14	14,9
Width at level of auditory apertures	37,6	38	38	38	36,7	38,9	40	38,6	37,2	40	35,8	38,3	39,5	39	d.	37,5	36,6	38,2	38,2
Lateral length of braincase	36,3	36,1	35,3	36,7	38,2	35,6	37	36,2	39	39,3	36	37,2	35,3	38,2	36,2	35	35,7	37,5	36,7
Lateral length of facial part of skull	44	45,2	46,2	44	44,2	46	47,7	46,6	44,2	47,7	41,6	47,1	45,3	47,6	45,2	46,3	46,3	48,5	46,0
Length of bony palate	6,2	7,2	7,1	7,9	7	6,6	6	7,7	7,6	7,2	6	7,1	6	7,9	5,5	7,1	6,2	8,1	6,8
Width of incisive foramina	11,7	11,5	12	12	10	12,7	14,6	12	13	13,7	11,5	11	12,7	12,9	12,7	10	11,2	11,9	12,2
Length of incisive foramina	26,3	27	29	26,1	25,2	26	29,2	27,3	27,5	27,6	24,6	27,7	27,2	27,8	27,8	25,5	27	28,4	27,4
Length of zygomatic arch	40	41,2	42	39,2	38,5	40,1	43,2	40,2	40,5	41,3	37,5	41,2	40,6	42	38,2	40	41,7	42,7	40,6
Length of upper tooth row	18,6	17,3	18	17,3	17,3	18,2	19,1	17,6	17,6	18,7	17	18,2	19,3	18	18,6	17,7	18,8	18,2	18,2
Upper diastema	28,2	30,3	32	31	29	28,5	30,2	29,2	30,7	31	28	30,2	30	32	29,5	29,5	29,8	31,7	27,4
Length of body and head	610	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	90	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet	170	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear along concavity	132	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 14

Measurements of Lepus europaeus Pall.

Subspecies	Lepus europaeus transsylvanicus Matschie																
	No. M.2916 ♂ 9 Oct. 1923. The Crimean State Reserve. A. Gunali	No. M.2917 ♀ 8 Oct. 1923. Near Beshui, Crimean State Reserve. Rozanov	No. M.2918 ♂ 21 Sep. 1923. Ibidem. Gunali	No. M.2919 sex 17 Oct. 1923. Al'ma Bakla, Crimean Reserve. Gunali	No. M.2920 ♀ 21 Oct. 1923. Beshui. Gunali	No. M.2921 ♀ 17 Oct. 1923. Al'ma Bakla. Rozanov	No. M.2922 ♀ 18 Oct. 1923. Beshui. Merkulov	No. M.2924 ♂ 21 Oct. 1923. Beshui. Merkulov	No. M.2926 ♀ 29 Jan. 1914. Inkerman. Crimea. Martino	No. M.2927 ♀ 28 Jan. 1914. Ibidem	No. M.2928 ♀ 3 Feb. 1914. Bel'-Bek. Martino	No. M.2929 ♂ 3 Feb. 1914. Ibidem	No. M.2931 sex. 14 Feb. 1914. Inkerman. Martino	No. M.2932 ♀ 7 Feb. 1914. Between Bel'-Bek and Serkes-Kerlik. Martino	No. M.2936, Oct. 1912. Mekenzievy mountains, near Sevastopol. Martino	No. 1467 ♀ 7 Apr. 1908. Albania, near Corfu. S. I. Ognev's collection	Lepus e. transsylvanicus. Average
Length of skull	101	97	92	96	90	98.2	92.5	89.3	100.5	97.8	96.7	93	95.3	93	96.5	90.3	94.9
Basal length of skull	76	76.5	70	73.5	68	74.5	70	68.3	75	74.9	75	70.5	72.7	71	74.2	69.2	72.4
Condylobasal length of skull	88.2	86.2	81.1	85	78.2	83	83	80	89	85	85.5	82	84.1	79	85.2	71.6	83.6
Zygomatic width	48.2	47.2	43.2	46.3	45.9	48	44.6	45.2	47.6	46.8	46.2	46	46.5	44.2	47.5	44	46.1
Length of nasals	46.5	45.7	40	41.7	40	45.2	43	37.2	45.7	44	44.8	41.3	42.5	44.3	45.9	41	43.1
Width of nasals	21.1	19.5	18	20	17.9	19.2	17.3	16.8	19.9	19.9	18.6	17	21	17	19.6	15.5	18.6
Width of nasal foramen	16.1	13	12.7	14.6	12.3	14.9	12.5	11.8	14	15	13	12.8	17	11.5	15	10.6	13.6
Width at level of auditory apertures	36	34	34	36.6	35	35.8	—	34	36	35.7	35.2	36.1	35	32.1	36	35	35.1
Lateral length of braincase	35	33	33.3	35	34.2	36	34	33	35.3	34.8	36	35.2	34.6	33.1	37.2	35.2	34.7
Lateral length of facial part of skull	48	43.2	42.8	42.9	40.2	43.8	39.8	38	44.1	41.8	42.3	40	42	41	42.9	38	41.9
Length of bony palate	6	6.2	7	6	6	6	5	5.6	7.8	7.8	6.1	5.8	6.3	6.7	6.7	6.3	6.2
Width of incisive foramina	13.3	10	10.1	12	10.5	12	11	9.6	11.3	11.8	11.1	10.6	11	11.2	11.2	11	11.1
Length of incisive foramina	27	24.9	25	25	23.4	24	23.7	23	25.2	26.1	24.7	24.3	26.1	24.6	25.2	23.7	24.7
Length of zygomatic arch	36.1	37	35.7	36	36.1	38	36.2	35.2	39	39	38.2	36.1	38.1	37	38.6	34.5	36.9
Length of upper tooth row	18.1	18.1	16.3	17	16.2	18	16.2	16.7	17.7	17.7	17.1	17	15.3	15.8	17	16	16.9
Upper diastema	30	27.1	26.7	28	26.5	28.1	26.1	24	28.5	27.8	28.3	26	27.5	27.5	27.3	25.8	27.2
Length of body and head	562	560	550	560	560	580	600	550	—	—	560	580	590	580	—	500	564.0
Length of tail without terminal hair	83	75.5	80	76	90	75	100	84	—	—	123	115	145	144	—	103	99.5
Length of hind feet	152	150	140	—	140	155	160	140	—	—	146	150	157	150	—	124	147.0
Length of ear along concavity	102	110	107	—	107	118	110	112	—	—	104	100	108	103	—	106	107.2
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	121	120	135	123	—	133	126.4

TABLE 15

Measurements of Lepus europaeus Pall.

Subspecies	Lepus europaeus caucasicus O.																	
	No. M.2937 ♀ 30 Nov. 1923. Vicinity of Vladikavkaz [Ordzhonikidze]. S. I. Ognev's collection	No. M.2943 —/Oct. 1923. Ibidem.	No. M.2946, 14 Oct. 1923. Ibidem	No. M.2938 ♂ 2 Dec. 1923. Ibidem	No. M.2960 —/Oct. 1923. Ibidem	No. M.2963 —/Oct. 1923. Ibidem	No. M.2975 —/Oct. 1923. Ibidem	No. M.2959 ♂ 2 Dec. 1923. Ibidem	No. M.2965 ♂ 24 June 1923. Vicinity of Khasav-Yurt, Dagestan	No. M.2948 ♂ 15 Jan. 1925 Ozen' village, Dagestan. Vicinity of Makhachkala	No. M.2940 ♀ 15 Mar. 1925. Ibidem	No. M.2942 ♀ 15 Jan. 1925. Ibidem	No. M.2947 ♀ 25 Feb. 1925. Bakasinskaya Spit, Dagestan	No. M.2972 ♀ 22 June 1923. Karabudakhkent, Dagestan	No. M.2969 ♂ 22 June 1923. Ibidem	No. M.2971 ♀ 23 June 1923. Ibidem	Sex. 1925. Nogaiskaya Steppe. Formozov's collection	No. M.2966 ♂ 4 June 1923. Vicinity of Malaya Areshovka. Kizlyar Section. S. I. Ognev's collection
Length of skull	98	101.5	95.8	93.5	102.1	96.7	92	99	100.2	102.2	104.6	99.8	97.7	100.5	97	96	105	98.9
Basal length of skull	75.3	78.5	72.4	72	78.4	74.2	73.3	75.3	79.6	77	79.8	77	74	78	74.2	73.5	82.2	76.8
Condylobasal length of skull	87.1	89.6	85	83	90.5	86.8	84.3	87.2	91.5	88.2	93.3	89	86.2	89	86.5	85.2	94.2	87.3
Zygomatic width	47.3	47	46.1	45	48.8	44.7	45.3	49.1	d.	49	48.2	47.3	46.5	44.2	46.7	43.6	49.2	45.2
Length of nasals	46.1	48.6	43.2	41.2	45.2	44.8	44.9	46.2	47.1	48	46.7	46	44.9	46.2	46	41.1	47	48.8
Width of nasals	20.6	19.2	18	21.1	18.5	18.1	18.9	22.2	20.2	19.8	19.5	19.6	19	21.5	17	17	21.9	21
Width of nasal foramen	15.1	13.7	12.6	13.9	13.3	14.6	13	15.5	15.2	14.1	14.4	13	12.1	14.2	12.7	12.8	15.3	12.9
Width at level of auditory apertures	37.5	32.1	37.8	36.3	38.1	34.5	36.5	38.6	37	38.9	38	39	37.2	36.8	3[?].5	37	38.5	37
Lateral length of braincase	33	37.6	36.1	35	35.7	32.8	d.	37.9	37.2	38.2	38.6	36.6	37	36.3	35.3	35.3	39	33.2
Lateral length of facial part of skull	46.2	44	42.7	42	45	47.3	42.3	45.1	44.4	45.9	46.1	45	44	46.5	44	42.3	47.2	44.9
Length of bony palate	5	6	5.3	6	5.9	5.6	6.1	5.2	7.7	7	6.2	6.1	6.1	5.2	6.1	7	7	5.9
Width of incisive foramina	12.1	10.2	11	11.7	12.6	11	10.6	12.3	11.6	12	12	12	10	11	10.8	11.4	11	10.9
Length of incisive foramina	26.8	26	25.2	24.6	27.2	27	26	28	27	27.2	28.6	27.2	25.9	27.8	27	26.7	28	27
Length of zygomatic arch	40.7	40.9	39	37	40.1	39.7	38.8	40.2	40	42	40.9	39	39	39.2	38	38.3	39	39
Length of upper tooth row	16.9	16.7	16.1	15.2	18	16.6	16.2	17	16.1	17.2	18.9	17.5	16.1	17	17	15.2	18	17.9
Upper diastema	29.1	28.6	28.3	28	24.7	29.1	28.1	28.6	29.3	30.2	30.2	29.5	30	31.6	29.2	27.8	31.6	29.3
Length of body and head	565	—	560	520	—	—	—	585	—	673	—	680	650	—	620	670	—	—
Length of tail without terminal hair	108	—	112	83	—	—	—	104	—	83	—	110	110	—	89	93	—	—
Length of hind feet	152	—	154	145	—	—	—	154	—	167	—	160	150	—	141	140	—	—
Length of ear along concavity	115	—	112	104	—	—	—	104	—	—	—	—	105	—	—	—	—	—
Length of ear from occiput	—	—	—	—	—	—	—	—	—	137	—	135	—	—	143	171	—	—

TABLE 16

Measurements of Lepus europaeus Pall.

Subspecies	Lepus e. caucasicus Ogn.					Lepus europaeus eyrensis Satun.												
	No. M.2967 ♂ 7 July 1922. Vicinity of Malaya Areshovka, Kizlyar Section	No. 2-09 ♂ Fall, 1907. Above the forest belt, 7000' to 8000'. Bogos Range	No. 2-09 ♂ 1907. Ibidem. P.N. Galkin	No. S.4979 ♀ 27 Aug. 1928. Village Beta. Chernomorskii District	Lepus e. caucasicus. Average	No. S.2049, 1910. Baku Province. Transcaucasia. A.N. Karamzin	No. S.2050. Ibidem	No 52 ♂ 20 July 1927. Armenia, Lake Sevan near Yelenovka. L. and S. Turov	No. 50 ♂ 20 July 1927. Armenia, Lake Gokcha, Yelenovka	No. S.3335, 28 Dec. 1915. Mugan Steppe. D. Golovin	No. M.3312 ♀ 22 Jan. 1929. Vicinity of Yerevan, Artemisia steppe. A.B. Shelkovnikov	No. 2 ♂ 28 Jan. 1920. Ibidem	No. 3 ♀ 28 Jan. 1929. Ibidem	No. 4 ♂ 1 Feb. 1929. Ibidem	No. M.3307 ♂ 1 Feb. 1929. Ibidem	No. 6 ♂ 26 June 1928. Lake Sevan, Shardzha Village, slope of the Shakh-Dag Range	No. (129e.) ♀ —/Dec. 1904. Barda, Dzhevashirskii County of the Yelizavetpol [Kirovabad] Province. Collection of the Georgian Museum	No. 129, 1/0 ♂ 11 Feb. 1905. Yekaterinofeld [Balnisi] Borchalo [Mameuli] County
Length of skull	99.2	100	98.8	103	99.2	98.5	91	98	99	95.7	96	95.7	94.1	95.7	94.2	96.9	99.8	103
Basal length of skull	76.1	79	77.1	82.7	76.6	77	d.	74.9	76.6	76	74.2	72.9	72	72.6	72.6	74.5	76	79
Condylobasal length of skull	88.1	88.7	87.3	92.1	88.2	88.1	84	87.3	88.2	87.2	85.2	85.1	83.6	86.2	83	86	86.8	90.3
Zygomatic width	43.6	48	45.2	49	46.6	45	46.1	48	47	46.3	45.2	45.8	45.3	47	46	48.7	47.3	48
Length of nasals	48	44	46	46.3	45.7	46.1	42	44	45.7	42.3	42.3	44	40	43	44.2	44	46.7	47.2
Width of nasals	16.3	18.9	18.2	19.9	19.4	22	18	19.6	18.6	18.8	17.3	18	13.2	18	19.2	22	18.3	20
Width of nasal foramen	12.3	15.2	14.6	13	13.2	15.1	13.3	14.6	14.1	13.9	13.8	14	11.9	13.2	13.9	13	14	15
Width at level of auditory apertures	32	37.2	37	36.2	36.8	36	34	37.6	39.1	36	36.7	37.2	37	d.	36.2	37.8	d.	d.
Lateral length of braincase	33.2	36.1	35	36.3	36.0	35	34	33.5	35.1	32.9	34	34.9	34.7	33.2	35.5	35.7	35.1	37.2
Lateral length of facial part of skull	45.1	42.5	43.7	46.1	44.6	44.1	40.2	44.2	43.8	42.1	42	42	39	42.2	42.8	41.5	43	43.3
Length of bony palate	6.2	7.7	6	6.1	6.2	d.	6.9	5.2	7	6.6	6.7	5.5	6	6.2	6.8	6	6	7
Width of incisive foramina	10	11.1	11.2	11.6	11.3	10.2	11	12.7	12	11.1	12	11.1	10.7	11.4	10.3	11.9	13	12.7
Length of incisive foramina	27	26.5	25	27	26.8	25	24.9	26.2	26.1	25.2	25	25.1	23	23.5	24.2	25.7	26.1	27
Length of zygomatic arch	d.	41	40.1	41	39.7	38	37	38.2	36.6	39.1	39.1	38.1	37	38.5	37.3	39.6	39	39
Length of upper tooth row	15.8	17.5	16.8	18.3	16.9	17.2	16.3	17.8	18	16.5	16.2	16.7	16.7	16.3	16.9	17	18.0	18
Upper diastema	28.8	28.6	28	28.9	29.0	28.7	26	29.1	29	28.9	27.6	28	26	27.6	27	27.6	28	30
Length of body and head	—	—	—	Lepus e. caucasicus natio ponticus Ogn.	613.7	—	—	545	490	—	530	570	560	560	531	—	—	—
Length of tail without terminal hair	—	—	—		99.1	—	—	70	102	—	115	120	120	110	105	—	—	—
Length of hind feet	—	—	—		151.4	—	—	144	149.9	—	140	145	140	140	130	—	—	—
Length of ear along concavity	—	—	—		108.0	—	—	112	114.9	—	120	120	115	120	110	—	—	—
Length of ear from occiput	—	—	—		146.5	—	—	143	146.1	—	—	—	—	—	—	—	—	—

TABLE 17

Measurements of Lepus europaeus Pall.

Subspecies	Lepus europaeus eyrensis Satun.															
	No. 129, 1/n. ♂ 11 Feb. 1905. Yekaterinofeld [Bolnisi], Borchalo [Mameuli] County	No. 129, 1/k. ♂ —/Dec. 1904. The Barda Post Station, Dzhevatskii County, Yelizavetpol [Kirovabad] Province	No. 26-07, 27 Apr. 1907. Emakchi, Lenkoran County. Kaznakov and Shelkovnikov	No. 26-07, 28 Apr. 1907. Ibidem	No. 40-06, 7 July 1906. Dzhi Village, Lenkoran County	No. 129, 1/f. ♀ 8 Dec. 1904. Geok-Tapa, Areshskii County	No. (4-05) 129 1/h ♂ Jan. 1905. Areshskii County	No. 13-26 ♂ 31 Jan. 1926. Akstafa, Yelizavetpol [Kirovabad] Province	No. 129, I/m. ♀ —/Dec. 1904. Grakali, Gori County. Tiflis Province	No. 129 sex? Z ♂ July 1898. Bakuriani, Gori County	No: 129, I/r. 4 Dec. 1905. Khaki Village, near Akhaltsikh. Kobylin	No. 1-1910. Jan. 1910. Vicinity of Ardebil'. Kaznakov and Shelkovnikov	No. 2207, 5 Jan. 1907. 1. Yalama, Kuba County. Kobylin	Sex. Jan. 1907. Sukhumi District. Kaznakov and Shelkovnikov	No. 202-16 Nov. 1916. Tsikhis-Dziri, Batumi District. A. Bykov	Lepus europaeus eyrensis Satun. Average
Length of skull	100	91.1	95.3	93.6	96	97.5	96.9	99.2	93	97.7	92.2	98.1	99.3	97.6	96.7	96.5
Basal length of skull	79.1	72	75	73	75.2	76	d.	76	73.2	76.7	70.8	75.7	76.8	73.9	75.5	74.9
Condylobasal length of skull	89.8	80.3	85	83	86.5	85.6	d.	88.2	84.3	87.9	82.2	86.3	87.7	86.6	85.5	85.9
Zygomatic width	48	43.2	44	43.5	45.9	46.7	45.2	47	45	47.2	45	48	48.2	42.7	d.	46.1
Length of nasals	45.1	38.1	45.2	43	46.6	46.9	43	46	43	44.9	40.6	45.2	44	42.5	39.9	43.8
Width of nasals	20	16.5	16	19	18	18.7	20.9	17.2	18	19.1	16.7	18	21	16.6	19	18.5
Width of nasal foramen	14.5	12.3	14.1	15.1	15.2	14	15.2	14.2	14.8	16.2	14.2	13.5	15.2	13.2	14.7	14.2
Width at level of auditory apertures	d.	d.	35	35.2	35.6	d.	36	36.1	d.	36.1	d.	38.7	37	35	37	36.5
Lateral length of braincase	35	33.6	36.1	33.1	35.7	35	38.3	35.8	d.	36.1	34	35.2	35.7	34.9	35.2	35.0
Lateral length of facial part of skull	44	39.2	39.2	41	42.2	41.3	40.2	43.1	40	42.2	38.3	41.2	45.1	41.3	41.9	41.8
Length of bony palate	6.7	5	7	5.2	5.3	7.1	6.2	6.1	7	6.2	5.7	6	7	6.1	6.2	6.2
Width of incisive foramina	12	10.7	10	9.5	11.2	11.2	11	10	11.2	11.7	10.5	11.1	13	10.2	12	11.3
Length of incisive foramina	26.2	24.7	25.2	25.2	26	25.6	25.2	26	25.7	26	23.3	25.2	26	27	26.6	25.4
Length of zygomatic arch	40	35.3	35	35	36.1	38.2	35.6	39	37.3	38.3	36.2	40.2	39.8	36.8	38.7	37.8
Length of upper tooth row	17.5	17	16.2	17.2	16	18.5	17.8	17	18	16.3	16	18	18.3	17	17.7	17.1
Upper diastema	29.6	27	27.7	27.5	28.6	28	27.5	29	27	19.9	26.7	26	29.3	27.6	29	28.0
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	540.8
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	106.0
Length of hind feet	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	141.3
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	116.0
Length of ear from occiput	—	Typus!	—	—	—	—	—	—	—	—	—	—	—	—	—	144.6

TABLE 18

Measurements of Lepus europaeus Pall.

Subspecies	Lepus europaeus caspicus Ehrenb.																								
	No. M. 1980, 11 June 1927, Yenotaevka County, Astrakhan Province. Peski (?). K. A. Vorob'ev	No. M.1981 ♀ 11 June 1927. Ibidem	No. M.3016 ♂ 27 Jan. 1913. Khokhlatskoe village, Astrakhan County. N. A. Chugunov	No. M.3019 ♂ 27 Jan. 1913. Ibidem	No. M.3021, 27 Jan. 1913. Ibidem	No. M.3022, 27 Jan. 1913. Ibidem	No. 310 ♂. Vicinity of Uralsk. B. A. Kuznetsov	No. 311 ♀. Ibidem	No. 312 ♀. Ibidem	No. 313 ♂. Ibidem	No. 315 ♂. Ibidem	No. 316 ♂. Ibidem	No. 317 ♀. Ibidem	No. 318 ♂. Ibidem	No. 319 ♀. Ibidem	No. 320 ♂. Ibidem	No. 322 ♀. Ibidem	No. 323 ♀. Ibidem	No. 326 ♀. Vicinity of Uralsk. B. A. Kuznetsov	No. 2309, 24 Aug. 1928. Peski, Akity, Ikitsokhurovskii District, Kalmyk Region. E. I. Orlov	No. 2306, 9 Aug. 1928. Chelon-Khatur, Yergeni, Kalmyk Region	No. 2307, 9 Aug. 1928. Ibidem. E. I. Orlov	No. 2308, 20 Aug. 1928. Malye Udzha, Ikitsokhurovskii District. E. I. Orlov	No. 2305, 9 Aug. 1928. Chelon-Khatur, Yergeni. E. I. Orlov	No. 456 ♂ 21 Apr. 1925, D'yakovka, Kalmyk Region	Lepus europaeus caspicus. Average
Length of skull	102.6	102.1	97.2	95.3	102.3	98.7	102.1	102	103	101.4	102.3	102.1	103.1	98.9	96	98.2	101	99.2	97.8	101	102	95	98.5	100.2	101	100.0
Basal length of skull	79.2	78.7	73.2	71.8	78.3	76.3	83.1	81.2	81.6	78.4	81.2	80	81.2	78.1	77.9	76.7	78.8	76.5	77.2	79	79.9	73.3	75.6	78	78.1	78.1
Condylobasal length of skull	91	90.8	85	84	91	87.7	90.8	90.6	90.2	89.2	91.2	90.4	91.2	87.2	87	87.2	89	86.2	87.2	89.1	90.6	84.2	88	89.0	89.1	88.7
Zygomatic width	48.2	d.	48.2	d.	47	45	49.2	47.2	50	47.2	47.8	46.2	48	46.6	48.8	47.2	47	46.4	46.6	48.6	48.7	46.2	48	46.5	50.1	47.6
Length of nasals	46.9	47.5	44.1	41	45.9	44.5	45.8	47.8	48.8	47.4	46.4	46.4	d.	46.5	44.2	45.8	47.9	44.2	44.2	47.5	46.3	43	47.7	48.2	45.8	46.0
Width of nasals	19.3	19.2	18.8	17.8	21	17.6	21.2	19	20	20	19.8	20.1	21.6	19.8	18.2	19.5	19.3	18.6	20	19.9	18	18.5	18.2	18.8	20	19.4
Width of nasal foramen	13.2	13	14.1	15	14.8	13.2	16.2	14.5	14	15.2	15.1	16	15.2	13.7	14	15	13.6	13.3	13.7	15.6	14.2	14.2	16	15.2	16.2	14.6
Width at level of auditory apertures	37.6	37.7	37.3	34.5	37.4	36.8	36.2	38.1	d.	37	35.2	38.7	36.2	37.1	37	38.2	37.9	35.6	37	38	39.3	d.	37	37.1	37.6	32.2
Lateral length of braincase	36.5	35	36.1	34.6	38	35.2	35.2	35.1	37.2	34	36.2	38.1	36.1	36	34.7	34.5	36	35.7	34.5	37	34.8	33.8	35	35	37.5	35.7
Lateral length of facial part of skull	45.2	48	42.2	41.6	46.5	44.1	44.8	45.2	48.1	45.2	47.3	46.5	46.6	43.6	44.2	44	44.2	44.2	43	44	44.6	41.9	43.1	44.5	45	44.7
Length of bony palate	7.1	d.	6.2	7.1	6.5	7.1	7	8	7.1	6.2	7.2	5.7	6.7	6.8	5.9	7.7	7.2	6.6	7	7	6.5	7	7	7.9	7	6.9
Width of incisive foramina	12.1	d.	11.2	9.8	11.1	11	11.2	11.2	11.7	12.3	11.1	11.6	11	11.2	11.5	11	10	10.2	10	11.3	13	12	10	11	11.1	11.6
Length of incisive foramina	30	28.9	26	28.8	26.6	26.5	27.2	26.8	26.8	27.2	27.3	29.2	26.2	27.1	25.9	25.2	26.2	24	25.2	27.5	28	27	25	26.3	26	26.8
Length of zygomatic arch	41	42	40.2	38.4	40.5	39	41.2	40	41.3	40.3	40	39.8	40.1	40.7	38.9	39.9	40.1	38.2	39.3	39.7	41	37.8	39.5	38	40.3	39.9
Length of upper tooth row	18.5	19.5	17.2	18	18.3	17	18.2	18	18.3	17.8	18.2	18.5	17.7	17	19	16	17.3	17.2	16.8	18.7	19	17.6	17.9	18.6	18.8	18.0
Upper diastema	31.1	30.2	28.3	27.5	30.2	31.7	28.9	30	30	29.8	31.1	31	30.2	28.2	28.7	27.8	28.7	29.2	28	30.1	28.9	29	29.1	28.9	28	29.4
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	560	620	550	575	570	580	575.8
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	94	110	95	97	d.	110	101.2
Length of hind feet	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	165	150	146	155	145	152.2
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	108	120	100	105	100	100	103.5
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	138	150	140	142	130	—	140.0
																				L. e. caspicus natio kalmycorum Ogn.						

TABLE 19

Measurements of Lepus tolai Pall.

Subspecies	L. tolai tolai Pall.																
	No. (17) ♀ 14 July 1927. Lake Gusinoe, 16 km from Ulus	No. (23) ♀ 21 July 1927. Lake Gusinoe, right bank of Tsagan-Gol	No. M.3310 ♂ 19 Jan. 1928. Vicinity of Troitskosavsk [Kyakhta]. P. Mikhno	No. M.3311 ♂ 1 July 1927. Between Lake Tsagan-Gol and Burun-Tsaidam	No. M.3312 ♂ 4 July 1927. Lake Gusinoe	No. 3313 ♂ 2 Aug. 1927. Ibidem	No. M.3314 ♀ 4 July 1927. Ibidem	No. M.2323 ♀ 16 Jan. 1928. Vicinity of Troitskosavsk [Kyakhta]	No. M.2324, 16 Jan. 1928. Ibidem	No. M.1696 ♂ 16 Mar. 1927. Mondy village. Eastern Sayan Mountains, 25 km north of Lake Hőbsőgől	No. M.(3) 19 Jan. 1928. Vicinity of Troitskosavsk [Kyakhta]. P. Mikhno	No. M.(29) 31 July 1927. Lake Gusinoe, Tsagan-Gol	No. M.(32) 2 Aug. 1927. Lake Gusinoe, left bank of Tsagan-Gol	No. M.(2) 28 Dec. 1927. Lake Gusinoe. P. Mikhno	No. M.(1) 28 Dec. 1927. Ibidem	No. M.(26) 25 July 1927. Ibidem	Lepus tolai Pall. Average
Length of skull	87	88.1	92.1	91	88.5	88.6	89.5	95.2	92	90.5	91.3	89.1	95	92.3	88.5	91.5	90.6
Basal length of skull	68	70	72.5	70.2	68	70.2	72	75	70.3	70	72.5	d.	75.2	79.7	68.2	71	71.0
Condylobasal length of skull	78	79.7	82.1	80.7	78.3	81	81.2	86	82	82	83.2	81	87.1	83	78.7	82.1	81.6
Zygomatic width	43	43.3	45.3	45.7	42.3	45	44	47.8	44.8	43.3	44	44.2	46.2	46	46.2	42.3	44.6
Length of nasals	38.2	35.2	39	36.8	37.9	37	36	41	37	39.2	40.1	36	40.1	39	37.1	38.1	38.0
Width of nasals	16.2	14.2	17	17.5	17.7	16	15.3	19.3	18	17	17.9	16.1	18.9	17	17.2	17.2	17.0
Width of nasal foramen	13	11.3	11.7	13.1	13.3	12.2	13	13	13.8	11.3	13.3	12	14	13	13	13	12.8
Width at level of auditory apertures	34	34.7	37.7	d.	d.	d.	34.5	37	36.5	36	37	35	36	d.	36.6	d.	35.9
Lateral length of braincase	32.5	34.2	34.6	35	33.9	33.2	31	36.3	35.3	33.5	34	32.2	36	33.7	33	33	33.8
Lateral length of facial part of skull	38	37.9	38.3	37.3	37.5	38.3	39	42	38.2	39.2	38.5	38.1	41.2	37.3	37	42.1	38.8
Length of bony palate	5.7	5.3	5.3	5.9	6	5.7	5.3	7.1	5.2	7.2	6.8	5.2	5.2	5.3	5.1	5	5.7
Width of incisive foramina	9.8	9	10.1	11.2	10.8	10.2	10.1	11	11	10.2	11	10.2	11.6	10.4	10.7	11.3	10.5
Length of incisive foramina	22	22.8	23.1	23	22.2	23.2	23	23	23.2	22.6	22.7	24	25.8	22	24	23.7	23.0
Length of zygomatic arch	34	34.7	37.9	37.1	35.2	32.7	d.	39.3	36.7	37.2	36.7	35	38	37.3	35.2	35	36.1
Length of upper tooth row	16	16	16.1	17	15.6	17	16.7	18.2	16.8	17	17	15.2	17	18	17	17.9	16.8
Upper diastema	24	24.2	24.9	25.2	24	23.1	25.8	26	25	25.6	25.6	24	25.6	23.5	23	25.8	24.7
Length of body and head	480	–	480	500	520	470	580	460	510	500	500	480	490	500	430	480	492.0
Length of tail without terminal hair	75	–	90	110	95	90	85	90	100	105	95	85	95	90	85	100	92.6
Length of hind feet	120	–	135	–	120	110	120	130	130	130	130	115	115	130	130	115	123.6
Length of ear along concavity	90	–	95	95	90	85	95	100	90	115	100	90	98	85	90	105	94.9
Length of ear from occiput	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 20

Measurements of Lepus tibetanus Waterh.

Subspecies	Lepus tibetanus lehmanni Severts.																	
	No. M.3053. Summer 1921. Kara-Uzyak on the Syr Darya. S. I. Ognev's collection	No. M.1712 ♀ 2 June 1925. Kara-Keshken, former Perovsk [Kzyl-Orda] County. Zhelokhovtsev	No. S.4981 ♂ 12 July 1926. Sur-Aryk, Perovsk [Kzyl-Orda] County. S. P. Naumov	No. S.4033, 25 Mar. 1915. Vicinity of Perovsk [Kzyl-Orda]. G. A. Kozhevnikov	No. S.4134, 24 Mar. 1915. Ibidem	No. S.4982 ♀ 18 July 1924. Kara-Uzyak railway station on the Syr Darya	No. S.4985 ♀ 26 May 1925. Ibidem	No. S.4983 ♂ 19 May 1925. Ibidem	No. S.4984 ♀ 3 May 1925. Perovsk [Kzyl-Orda] County. Ibidem	No. 17 ♂ 15 May 1925. Kara-Uzyak. former Perovsk [Kzyl-Orda] County. S. P. Naumov	No. M.1670. Late March 1927. Rybachii Village, Lake Issyk-Kul. Ozarovskii	No. S.6342 ♀ 4 Mar. 1932. Ak-Kuyu Well, 60 km north of Dzhebel Station, Central Asian Railway. S. P. Naumov, N. Lavrov	No. S.6343 ♂ 4 Mar. 1932. Ibidem	No. M.3056 ♂ 25 May 1909. Bank of Black Irtysh, Semipalatinsk Region. G. I. Polyakov	No. M.3055 ♂ 24 June 1909. Ibidem	No. S.4035 ♂ 14 June 1909. Left bank of Black Irtysh, Semipalatinsk Region. G. I. Polyakov	No. 2666 (472) ♀ 24 Aug. 1929. Kara-Bulak, Semipalatinsk Region, Zaisan Region. B. A. Kuznetsov	No. 2668 (480) ♂ 25 July 1929. Ibidem
Length of skull	84	84.1	87.8	88.2	82	87.1	86.8	83	85	85.2	83.1	81.2	81.2	83.8	87.2	84.7	90	89.3
Basal length of skull	64.2	64	67.7	68.3	68.7	67.2	67.2	68.2	68.2	67.6	68.7	62.3	63.5	65.7	67.2	67.6	70.3	70.2
Condylobasal length of skull	74.2	74.8	78	79.2	74.4	78	78.3	75.2	74.5	78	74.1	71.2	72.8	76.2	77.8	79.2	81.1	80.2
Zygomatic width	40.1	42.8	39.6	40.2	40.3	40.7	40.9	38.5	42.1	39.2	39.5	38.6	38.3	41.4	43	43.1	42.3	43.2
Length of nasals	35	36	36	37.5	34.2	36.3	38	35.2	34.8	34.9	34.8	36.2	32.8	41.7	38.8	34.1	40.2	40
Width of nasals	14.1	14.7	15	14.9	14	15	16	13.2	14.7	14	14	15.3	16.8	16	15.2	15	17.9	20.3
Width of nasal foramen	10	9.1	11	10.6	11.6	11.3	10.5	10	10.5	9.8	10.2	11.2	11.2	12	12.8	10.3	12.5	13.2
Width at level of auditory apertures	34.9	33.7	32.5	33.1	32.7	34.2	d.	32	32.8	33	33.2	32.7	29.7	34	34.5	d.	35.2	37.3
Lateral length of braincase	30.7	31.6	32.3	34.2	27.8	33	33.9	28.8	33.2	31.3	32.2	29	28.8	30.7	34	29.7	30.2	31.1
Lateral length of facial part of skull	36.2	35.3	36.7	38.9	31.2	36.2	36.3	35	36.2	35.1	33.2	34.8	33.6	36.7	37.3	32	41.3	39.2
Length of bony palate	5.2	6.2	7.1	6.3	6.2	6.2	6.9	5.2	6	7	7.1	6.1	6.1	6.1	5	6.1	6.2	5.7
Width of incisive foramina	9	9.2	8.3	9.3	8.3	9	9.8	7.3	9.2	8.7	8	8.2	7.3	9.7	10	10	7.3	10
Length of incisive foramina	21	20.8	22.2	22.2	20.8	21.1	20.3	21.1	20.1	21.1	19.2	19.3	19.2	22.3	23.3	22.1	23.5	23
Length of zygomatic arch	33.8	34.2	35.2	35	33	36.1	35	33.2	33.5	35.7	34.6	32.8	33	—	34.1	—	35	38
Length of upper tooth row	16.1	16.2	15.8	16.5	16.9	15.5	15	15.5	15.5	15	14.2	14.3	14.9	16.1	16	16.6	16.3	17.8
Upper diastema	22.7	22	24.2	23.6	21.1	23.2	20	22.3	22.3	23.5	20.8	20	21	23.2	24.9	23	26.2	25.3
Length of body and head	—	450	485	—	—	—	—	387	485	440	—	—	—	—	—	—	490	471
Length of tail without terminal hair	—	90	75	—	—	—	—	92	107	85	—	—	—	—	—	—	102	88
Length of hind feet	—	111	120	—	—	—	—	115	126	112	—	—	—	—	—	—	127	128
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	113	90	—	93	91
Length of ear from occiput	—	—	110	—	—	—	—	127	126	126	—	—	—	124	118	—	—	—
												natio turcomanicus Heptn.		natio zaisanicus Satun.				

TABLE 21

Measurements of Lepus tibetanus Waterh.

Subspecies	Lepus t. lehmanni Severtz.					L. tibetanus subsp.				L. t. desertorum Ogn. and Heptn.					L. t. buchariensis Ogn.											L. t. pamirensis Blanf.	
	No. 2663 (461) ♂ 23 July 1929. Kara-Bulak, Semipalatinsk Region. B. A. Kuznetsov	No. 2664 (462) ♀ 24 July 1929. Ibidem	No. M.1991 ♀. Late July 1925. Post station on Aina-Bulak Highway. B. Rodendorg	No. M.1990 ♂. Ibidem	L. t. lehmanni Severtz. Average	No. M.3065 ♂ 17 June 1925. Sulyukli, Kopet Dagh. S. I. Ognev	No. M.3064 ♂ 9 June 1925. Near the village Verkhne-Skobelevskii, Kopet Dagh. Heptner	L. tibetanus subsp. Average	No. S.3324. Transcaspia. Varentsov	No. S.2065, Nov. 1887. Pul' and Khatum. Transcaspia	No. S.4041, 1 Mar. 1898. Geok-Tepe, Transcaspia. Varentsov	No. M.3066 ♀ 21 May 1925. Annau, Transcaspia. S. I. Ognev	No. S.6344, 16 Apr. 1932. Uch-Adzhi. Central Asian Railway, Turkmenia	Lepus t. desertorum. Average	No. M.3061 ♂ 31 Mar. 1914. Buzachi, southeast of Bukhara Highland. Bobrinskii	No. M.3059 ♂ 21 May 1914. Khatyn-Rabad, east of Termez	No. M.3058 ♂ 22 Apr. 1914. Ibidem	No. M.3057 ♀ 22 May 1914. Ibidem	No. M.3062 ♂ 22 May 1914. Ibidem	No. M.3060 ♂ 22 May 1914. Khatyn-Rabad, east of Termez. N. A. Bobrinskii	No. M.3067 ♀ 31 Mar. 1914. Buzachi, southeast of Bukhara	No. S.4987 ♀ 31 Mar. 1914. Ibidem	No. S.4986 ♀ 31 Mar. 1914. Ibidem	No. M.1247 ♀ 26 Oct. 1926. Vicinity of Chardzhou. Aleksandrov	Lepus t. buchariensis. Average	No. 22. 552. Pamir. M. P. Rozanov. ZMAN collection	No. 22551. Ibidem
Length of skull	89.6	85.8	90	84	85.6	84.2	86.2	85.2	80.6	d.	80.6	76.6	85.8	80.9	80.9	85.5	88.3	86.7	80	84.1	79	86	80	89	84.0	88.2	86.3
Basal length of skull	70.2	68.3	71.1	d.	66.6	66.5	64.2	65.4	62	d.	62	57.5	65.5	61.8	62.6	66.9	68.6	66.5	62.1	64	60.8	68.1	61.4	d.	64.6	68.3	67
Condylobasal length of skull	80.2	77.2	81.7	d.	77.0	76	79.5	77.8	71.4	d.	71.4	67.5	74.8	71.3	72.7	75.5	79.1	77.2	71.3	75.7	71.5	78	70.4	80.3	75.1	78.2	76.3
Zygomatic width	43.7	43.1	42	40	41.0	42.1	40	41.0	39	40.1	40	37	37.6	38.7	38.6	42.2	41.9	40.9	40.7	40.9	39.[?]	d.	38.9	41.3	40.5	41.4	41.1
Length of nasals	38.1	37.6	38.3	35.3	36.6	36	37.1	36.6	34.5	37.1	34.5	31.8	35.1	34.6	32.2	38.7	38.2	41.7	33.5	37.1	35.1	35.7	33.6	40	36.6	39.8	38.3
Width of nasals	20	19.3	16	15.2	15.7	15.1	15	15.0	13	14	14.5	14	13	13.7	14	16	14	15	14.2	13.2	14.2	14.9	14	15.1	14.5	14.2	14.3
Width of nasal foramen	12.3	12.2	11	10.5	11.1	11.5	11	11.2	9.5	9.6	10.7	9.3	9.2	9.7	10.7	11	10.8	10.2	11	10	10.8	11.1	10.2	11	10.7	12	11.3
Width at level of auditory apertures	35.9	34.5	36.5	33.5	33.8	d.	34.6	34.6	32	d.	d.	30.7	31	31.2	31	35.5	34.5	34.5	33.5	33.3	31.7	d.	33	34.1	33.5	35	33.4
Lateral length of braincase	29.8	32.2	34.6	30	31.3	32.3	32.8	32.6	31.1	d.	d.	30.7	31.1	30.9	30.1	32.9	34	34	31.9	33.1	30.1	33.1	30.9	32	32.2	31.2	32.3
Lateral length of facial part of skull	39.1	38	38.5	39.2	36.1	36	36.3	36.2	34.2	37.2	35	31	36.8	34.8	34.4	37.3	33.9	36.5	33	35.1	33.6	36.3	35.2	38.8	35.4	40	37
Length of bony palate	6.3	6.1	6.3	6	6.2	6	5.7	5.8	6	5.5	6	5.2	5.7	5.7	5	6.1	6	6.7	5.3	5.9	5.3	5.8	5.7	d.	5.8	6.3	7.3
Width of incisive foramina	10.2	9.6	9	8.2	8.9	10	9.6	9.8	9	9	10.3	8	8.1	8.9	9.1	10	9.3	9	8.2	9	9.2	9.2	8	d.	9.0	8	8
Length of incisive foramina	23.2	21.6	23.1	19.2	21.4	22.3	20.3	21.3	19.2	21.1	22	18.3	20.8	20.3	20.5	22.9	22.9	21.5	20	21.1	21.1	21.7	20.9	d.	21.4	22.8	23.2
Length of zygomatic arch	34	35.2	36.7	34	34.6	35.2	35.2	35.2	31.2	34	34.2	30.2	33.8	32.7	32	35.7	35.2	34.8	33.2	33.7	31.2	d.	31.3	37.7	33.9	35.3	35.2
Length of upper tooth row	16.2	16	16.2	15.3	15.8	14.1	14.9	14.5	13.9	16.2	13.9	13	15	14.4	15	15.9	15.1	15.8	15.3	15	15.5	15.9	15.3	16.5	15.5	16.2	15
Upper diastema	24.3	23.6	24.3	22	23.0	24.2	23.5	23.8	22	22	23.2	20.4	22.5	22.0	21.5	24	23.7	23.6	21	22.1	22.2	23.1	21.9	23.6	22.7	25.1	25.6
Length of body and head	443	446	—	—	455.9	435	460	447.5	—	—	—	399	—	399	—	505	530	—	460	—	—	—	—	447	485.5	—	—
Length of tail without terminal hair	110	116	—	—	97.8	75	87	81.0	—	—	—	79	—	79.0	—	120	—	—	—	—	—	—	—	98.2	109.1	—	—
Length of hind feet	128	120	—	—	119.8	121	121	121.0	—	—	—	112	—	112.0	112	113	119	106	110	117	107	115	107	121.3	112.7	—	—
Length of ear along concavity	96	83	—	—	89.5	108	119	113.5	—	—	—	98.2	—	98.2	105	106	117	95	99	102	101	99	102	—	102.9	—	—
Length of ear from occiput	natio zaisanicus Satun.				110.0	139.2	—	139.2	—	—	—	121	—	121.0	—	—	—	—	—	—	—	—	—	123	123.0	—	—

TABLE 22

Measurements of Lepus timidus Linn.

Subspecies	Lepus timidus timidus L.													Lepus t. kozhevnikovi Ogn.				
	No. M.2810 ♀ 29 Aug. 1923. Vicinity of Murmansk. V. G. Heptner	No. S. 2739, 1913. Kanin. S. V. Pokrovskii	No. M.3089 ♀ 7 July 1928. Berezov, Tobolsk Province. L. A. Portenko	No. M.3092, 1925. Valdai County, Novgorod Province. O. A. Kharuzin	No. M.3088 Nov. 1925. Ibidem	No. M.3091 ♂ 17 July 1925. Ibidem	No. M.3090 ♀ 20 Aug. 1925. Ibidem	No. 122, 1928. Vychegda. A. Chirkov	No. 123, 1928. Ibidem	No. 120, 1928. Ibidem	No. 404, 10 June 1913. Surgut, estuary of Chernaya River. S. M. Chugunov	No. 3177 (H.261), 20 June 1898. Ongudai, Altai. N. F. Kashchenko	Lepus timidus timidus L. Average	No. M.3094, 1912. Luga County, Peterburg Province. A. Tsel'min	No. S.3076, 1911. Ibidem	No. S.2370 ♂ 20 Nov. 1911. Bogorodsk County, Moscow Province. G. I. Polyakov	No. S.1894 ♂ Losinyi Ostrov, near Moscow. V. G. Durov	No. S.2343 ♀ 23 Oct. 1911. Biserovo Lake, Bogorodsk County, Moscow Province. G. Kozhevnikov
Length of skull	96	98.3	95.2	96.6	d.	98.9	101.7	96	92.7	93	99.9	98.8	97.0	95.3	d.	98.3	100.8	102.7
Basal length of skull	74.8	78.2	d.	75.7	d.	77.8	79.2	75.2	70.7	71.6	78.2	77	75.8	73.2	d.	75.6	79.3	81
Condylobasal length of skull	81	90.8	85	88	d.	90.4	91.3	87	82.5	83	89.9	88.8	87.6	86.1	d.	87.5	91	94
Zygomatic width	49.6	50.8	48	49.1	49.2	50.2	45.9	49	47.2	48	50	51	49.0	49	49.5	49.8	52.8	54.3
Length of nasals	40	41.2	37.3	40.8	41.6	39.8	40	39.2	39	35.7	41	40.2	39.6	39.1	43.2	41.9	41.9	45
Width of nasals	19.1	17.8	18.9	18	18.8	18.6	18.2	15.9	16.5	17.8	16.6	17.7	17.8	17.4	17.6	17.6	18.7	19.2
Width of nasal foramen	15	15	13.2	15.3	14.6	15.1	14.3	12.6	12.5	14.6	13.6	15.2	14.2	15.1	14	13.9	14.1	14.1
Width at level of auditory apertures	36.7	40.2	36.1	37.9	d.	39	38.8	37.9	37.2	38	40	37.6	38.1	36	d.	40	39.6	d.
Lateral length of braincase	34.2	37	36.5	35.3	d.	36.1	40.5	37	36	36	38.3	39.2	37.9	37.2	d.	37	39.8	38
Lateral length of facial part of skull	41.9	42.5	42	41.2	41.8	42.1	44	40.5	39.5	38.9	42.1	40.9	41.4	40.9	44.9	44.2	43.9	44.2
Length of bony palate	7	7.6	7.1	7.9	8	7.3	8.2	7.3	7.6	8	7.1	7.2	7.5	8	8.7	8.9	7	8.5
Width of incisive foramina	10.7	8.8	10.2	10	11.2	10.6	11	9	9	9	10.5	10	10.0	11	10.5	9.3	11	11.1
Length of incisive foramina	23.1	24	d.	23	23.1	25.2	24.7	24	22.8	22.7	22.9	22.1	23.4	22.1	25.5	23.2	24.2	24.3
Length of zygomatic arch	40	40.2	39.2	40	40.7	41.2	40	40.1	39	38.7	42.7	41	39.5	39	41.6	41.1	41.1	45.2
Length of upper tooth row	18.8	19.2	18.6	18.3	18.1	19.8	19.1	19.2	17.2	19	19.9	19	18.8	19	17.8	19	19	19.8
Upper diastema	27	28	d.	27.1	26.8	27.3	28.8	26.1	25	25	27.7	27	26.9	25.3	29.8	28.1	28.7	28.9
Length of body and head	610	—	—	—	—	—	—	—	—	—	—	natio lugubris Kastsch.	—	transitional to nominate subspecies		—	—	—
Length of tail without terminal hair	60	—	—	—	—	—	—	—	—	—	—		—			—	—	—
Length of hind feet	155	—	—	—	—	—	—	—	—	—	—		—			164	—	180
Length of ear along concavity	90	—	—	—	—	—	—	—	—	—	—		—			—	—	—
Length of ear from occiput	110	—	—	—	—	—	—	—	—	—	—		—			120	—	115

TABLE 23

Measurements of Lepus timidus Linn.

Subspecies	Lepus timidus kozhevnikovi Ogn.																		
	No. S. 2051 ♀ 7 Nov. 1910. Near Vishnyaki, Bogorodsk County. G. I. Polyakov	No. S. 3017 ♂ 20 Sep. 1915. Bogorodsk County	No. S. 2062 ♀ 6 Dec. 1909. Zyuzino, Bronnitsy County, Moscow Province. M. M. Kemer	No. S. 2327 ♂ 30 Oct. 1911. Bogorodsk County. G. I. Polyakov	No. S. 2298 ♂ 2 Oct. 1911. Poltevo, Bogorodsk County, Moscow Province. G. I. Polyakov	No. S. 2047 ♀ 26 Sep. 1910. Biserovo Lake, Bogorodsk County. G. I. Polyakov	No. S. 2053 ♀ 10 Oct. 1910. Zyuzino, Bogorodsk County, Moscow Province	No. S. 2055 sex.? 7 Sep. 1910. Bogorodsk County, Moscow Province	No. S. 2360 ♂ 23 Oct. 1911. Moscow County. G. I. Polyakov	No. S. 2341 ♂ 16 Oct. 1911. Bogorodsk County, Moscow Province. G. I. Polyakov	No. S. 2086. 12 Jan. 1911. Motyakova, Moscow Province. G. I. Polyakov	No. S. 2299 ♂ 4 Sep. 1911. Bogorodsk County. G. I. Polyakov	No. 1704 sex? 1 Oct. 1908. Near Bel'e Stolby station, Moscow County. F. M. Proskumin	No. M. 3085. 6 Oct. 1911. Dyatlovo, Bogorodsk County, Moscow Province. S. I. Ognev	No. M. 3086. Dec. 1909. Vladimir Province and County. E. V. Pylnov	No. M. 3166 sex? 23 Dec. 1922. Shipovskii Forest, Pavlovsk County, Voronezh Province. Pashchenko	No. M. 3167. 17 Nov. 1926. Ibidem	No. S. 2187 ♀ Jan. 1911. Kuznetsk County, Saratov Province. N. F. Ikonnikhov	No. S. 2190 Jan. 1911. Ibidem
Length of skull	101.8	102	103.4	101.3	99	100.2	105.6	101	101.1	99.8	105	97.8	102.7	100	103	100.6	100	101	96
Basal length of skull	80.2	81	80.2	77.5	77.1	—	82	80	79.2	75.2	82	75.3	80.3	77.4	80	78	78.5	79	77.2
Condylobasal length of skull	91.6	93.2	93.7	91.1	90.2	90.8	95	90.9	92	88.2	93	88.4	93.1	90.8	93.3	90	91.2	90.8	87.1
Zygomatic width	50.5	52	50.8	52	50.6	50.4	53	52.2	50.5	50.4	50.4	50	52.3	52.3	50.6	49.2	52	52	—
Length of nasals	42.6	44	44.2	41.9	41.1	42.2	46.7	42.1	40.8	41.8	41.7	41.2	42	45.2	44	41.1	42	41.2	41
Width of nasals	19.1	18.1	18	20	18	17.5	18	17.1	19	18	19	16.7	18.6	18	19	18	19.6	17.3	17.7
Width of nasal foramen	15.1	15.1	16	14.8	15	15.3	14.1	14	15	14	14.8	13.8	d.	15.5	16.9	15	15.2	15	15.2
Width at level of auditory apertures	39	39.3	39.7	40	38.2	d.	40	38.2	38.7	37.5	35.3	38.5	40	38.2	38.8	37	39.5	38.2	38.2
Lateral length of braincase	38.1	37	37.2	39.2	37.1	35	38.2	37.6	37.5	36.7	36	36	39	38.2	37	38.5	39	36.2	35.8
Lateral length of facial part of skull	43.8	44	47.2	44	41.7	43.7	46	43.6	43.9	43.1	43.3	41.8	45	43.2	44.8	43.2	42.9	41.2	41.7
Length of bony palate	8	7.6	8.8	8	7.2	6.8	9.2	8.1	8.3	8.1	8.2	8	8.2	8.1	7.1	8.2	7.9	9	8.9
Width of incisive foramina	10	11	9.7	11.7	10.9	11.2	8.3	10.7	10.8	9	10	9	10.2	11	10.7	10	10.6	10.2	9.2
Length of incisive foramina	25.5	25	25.5	24	25	25.4	25.3	24.5	25	24.2	24.8	24.7	24.3	24.7	23.5	24.7	25	25	23
Length of zygomatic arch	42.1	40.2	42.6	42.1	43	40	43.1	42	43.6	42.3	41.1	41	44.2	40.7	43.3	41.8	43	41.3	37
Length of upper tooth row	20	20	20.3	20	18.1	18.1	20.1	19.2	19	19	19.2	19.1	18.9	19.1	20.8	19.5	19.2	19	19.3
Upper diastema	28.3	28.2	30	27.2	28.1	28.2	30.1	28.3	27.9	27.8	28.1	27.3	29	28	27.4	28	28	28	27.5
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet	—	—	—	—	—	—	—	—	178	163	—	165	—	180	—	—	—	173	—
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	—	—	—	—	—	—	—	—	118	110	—	112	—	114	—	—	—	115	—

TABLE 24

Measurements of Lepus timidus Linn.

Subspecies	Lepus timidus kozhevnikovi Ogn.															
	No. S. 2183 ♀ Jan. 1911. Kuznetsk County, Saratov Province. N. F. Ikonnikhov	No. S. 2189 Jan. 1911. Ibidem	No. S. 2185 ♂ Jan. 1911. Ibidem	No. S. 2184 ♀ Jan. 1911. Ibidem	No. S. 2192 ♀ Jan. 1911. Ibidem	No. S. 2186 ♀ Jan. 1911. Ibidem	No. S. 2028, 2 Jan. 1911. Petrovsk County, Saratov Province. Kindyakov	No. S. 2029, 2 Jan. 1911. Ibidem	No. S. 2032, 2 Jan. 1911. Ibidem	No. S. 2027, 2 Jan. 1911. Petrovsk County, Saratov Province Kindyakov	No. S. 2026, 2 Jan. 1911. Ibidem	No. S. 2032, 2 Jan. 1911. Ibidem	No. S. 2671, 15 Dec. 1912. Vol'sk County, Saratov Province	No. S. 4549, 12 Oct. 1926. Il'menskii Range, near Miass, Ural. N. M. Dukel'skaya	No. S. 2550, 10 Sep. 1926. Ibidem	Lepus timidus kozhevnikovi. Average
Length of skull	101.5	102	101.3	100.3	98.8	98.8	95	97.2	99.7	97.5	96	99.7	101	96.2	97.1	100.0
Basal length of skull	79	79.2	80.3	78	76	78.3	75.7	77	78.3	75.5	74.7	78.1	83.6	77	75	78.1
Condylobasal length of skull	93	91.9	92	90.8	90.2	90	86.7	88.2	90.3	88.2	86.6	90.5	94.1	86.1	88	90.5
Zygomatic width	50.5	52.2	51	50.7	49.2	d.	50.7	48.5	d.	50.1	49	d.	53.1	48.6	50	52.3
Length of nasals	39.8	42	42	41.6	40.1	40.6	37	40.8	43.2	40.9	38.9	42.9	42.2	37.3	40.5	41.8
Width of nasals	18.7	18.7	17.9	17.9	17.8	17.8	16.9	18	18.2	15.6	17.2	18.1	18.8	18.3	17.8	18.1
Width of nasal foramen	15.2	16.2	14.3	14.2	15	15	14.9	14.2	15.1	14	d.	15.2	15.2	14	14	14.8
Width at level of auditory apertures	39.8	39	d.	d.	38	38.5	38.5	38	37.9	38	37	37.5	40	38	—	38.5
Lateral length of braincase	38.7	39.7	37.1	37.1	37.8	37.3	38.7	37	35.2	36.3	36.8	37.1	36.2	34	35	37.2
Lateral length of facial part of skull	42.2	43.9	43.2	42.3	44	41.5	41	44.4	42.2	41.8	40	42	44.2	40	40.2	43.0
Length of bony palate	9	8.7	9	8	9.2	8.8	7.9	7	7.1	7.8	8.1	7	7.9	8	8	8.1
Width of incisive foramina	10	12	10	11.2	10	10	10	10	12	11	9.1	12	12	10	10.5	10.4
Length of incisive foramina	23.6	25.3	24.5	24.9	22.8	23.7	23	23.7	25	23.2	23.8	25.1	24.2	24	23.6	24.3
Length of zygomatic arch	40.7	41.1	40.5	40.9	41.3	40.9	39.6	40	41.8	39.2	38.2	41.2	42	40.6	41.1	41.3
Length of upper tooth row	20.1	20.7	19.9	20	19.8	19.9	20	19.2	19.2	18.7	17.5	19	20	18.2	18.7	19.3
Upper diastema	27.2	28	28.2	27.9	27	26	23.2	27.1	28.8	28.2	28	28.1	28.2	25.2	26.3	27.8
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet	—	—	—	170	155	180	—	—	—	—	—	—	—	—	—	170.8
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	—	—	—	115	110	115	—	—	—	—	—	—	—	—	—	113.8

TABLE 25

Measurements of Lepus timidus Linn.

Subspecies	Lepus timidus sibiricorum H. Johansen														
	No. 4858 ♀ 7 Jan. 1914. Chulym River, Alty-Ryk Island, Novo-Kuskovo Village. V. E. Iohansen	No. H. 399 ♂ Nov. 1903. Vicinity of Kuznetsk, Tomsk Province. N. A. Korotkevich	No. H. 385 ♀ 4 Mar. 1900. Vicinity of Tomsk	No. H. 389 ♂ 6 May 1900. Vicinity of Tomsk. N. Mezentsov	No. H. 469 ♀ 30 June 1900. Ubinskoe, Tomsk Province. M. Tolmenov	No. S. 2141 ♀ 23 Jan. 1911. Zmeinogorsk County, Tomsk Province. Lavrov	No. S. 2139 ♂ 11 Nov. 1910. Ibidem	No. S. 2135 ♂ 5 Feb. 1911. Ibidem	No. S. 2137 ♂ 5 Feb. 1911. Ibidem	No. S. 2134 ♀ 27 Jan. 1911. Ibidem	No. S. 2136 ♂ 23 Jan. 1911. Ibidem	No. S. 2140 ♀ 11 Dec. 1910. Ibidem	No. S. 2138 ♂ 3 Nov. 1910. Ibidem	No. S. 2142 ♂ 23 Jan. 1911. Ibidem	Lepus timidus sibiricorum. Average
Length of skull	100	99.5	97	97.1	101.2	100	98.6	100	100.2	99.1	98	96.6	92.3	95.3	98.2
Basal length of skull	77.6	80.2	d.	77.3	78.9	78.2	75.2	76.8	79	76	76.3	76.2	70.9	73.3	76.6
Condylobasal length of skull	89.3	91.2	d.	88.8	90.7	90.3	88.2	90	91	88.2	88	88	83	85.2	88.6
Zygomatic width	52.9	50.6	49	50.6	49.8	53.2	49.8	50.4	50	47.1	49	49	46.7	48.3	49.7
Length of nasals	42	43.2	40.5	39.7	42.6	45.2	42.9	45	42.7	40.3	41	40.1	37.9	38.7	41.6
Width of nasals	18	18	19.7	18.7	18.3	20.7	19	20.9	19.6	18.8	16.9	17.5	17.3	17.6	18.6
Width of nasal foramen	15.3	15.1	d.	14.2	15.2	16.3	15.3	16.2	14.5	15	14	14.8	15.2	14.3	15.0
Width at level of auditory apertures	40	d.	38	38.2	37	38.3	39	39	39.2	38.2	38.8	38.8	d.	39.2	38.6
Lateral length of braincase	37.2	36.5	36	36	36.1	36	38	36.1	37.2	39.8	37.7	35.2	36.7	36	36.8
Lateral length of facial part of skull	43.7	43	d.	41.6	43.6	46.2	43.6	45.2	40.8	41.8	42	41.3	39.7	40.2	42.5
Length of bony palate	7.7	8.1	7.3	7.6	7.9	8	7.5	7.6	7.7	7.3	8.2	7.9	8	6.6	7.7
Width of incisive foramina	11	10	10.6	10.2	11	11.7	11	10	10	9.2	11	11.9	8.3	9.7	10.4
Length of incisive foramina	24.9	23.6	d.	23	25	24.7	22.3	24.2	24.9	24	23.8	23.2	21.4	23.7	23.7
Length of zygomatic arch	40.9	42	40.1	40.3	42.7	40	40.2	39	41.1	40.2	40.9	40	37.8	38.2	40.2
Length of upper tooth row	19	19.6	18.3	19	20	19.1	18.8	19	18.6	18.2	18.7	17.9	19	18.3	18.8
Upper diastema	28.5	28	d.	25.8	28	28.3	26.5	28	30.3	28	28	27.1	24.6	25.2	27.4
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet	190	—	—	168.3	158	—	—	—	—	—	—	—	—	—	172.1
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	117 Typus!	—	—	110	104	—	—	—	—	—	—	—	—	—	110.3

TABLE 26

Measurements of Lepus timidus Linn.

Subspecies	Lepus timidus transbaikalicus Ogn.													Lepus timidus gichiganus J. Allen		
	No. M.127, 1925 Barguzin, Transbaikalia. Z. F. Svatosh	No. M.126. Ibidem	No. M.125. Ibidem	No. M.923, 1925. Ibidem	No. M.924, 1925. Ibidem	No. M.3178 ♂ 23 Dec. 1924. Ibidem	No. M.926. Ibidem	No. M.925. Ibidem	No. M.922. Ibidem	No. 5045. Sosnovka, Baikal. S. S. Turov	No. 516 ♂ 22 Aug. 1928. Chindant, Chita District. B. Kuznetsov	No. 517 ♂ 22 Aug. 1928. Ibidem	Lepus timidus transbaikalicus Ogn. Average	No. 155 ♂ 25 Jan. 1932. Markovo, on the Anadyr. P. A. Portenko. Collection Arctic Institute	No. 153 ♀ 14 Jan. 1932. Ibidem	No. 154 ♂ 26 Dec. 1931. Ibidem
Length of skull	90.9	91.1	90.8	90	93.2	86	92.2	88.3	97	92.6	87.7	88.3	90.7	96.3	91	92.1
Basal length of skull	70.8	70.9	70.3	69	71.6	67.2	73.2	68.5	77	73	67.2	67	70.5	75.2	69.3	72.5
Condylobasal length of skull	83	81.9	82.2	81	84.6	76.3	84.1	80.8	88.2	83.7	77.3	78.2	81.8	85.3	80.6	84
Zygomatic width	48.2	47	46.2	46	46.3	45.6	48.7	46	49	47.3	45	45.2	46.7	49.6	46.6	47.9
Length of nasals	35.7	36.8	35.2	34.2	38	33	36.5	34.8	38.5	38.9	34.5	36	36.0	36.6	37.2	36
Width of nasals	16.7	15.7	17	16.2	16.7	16	16	16	18.6	15.9	15.8	16.2	16.4	16.2	14.7	16.5
Width of nasal foramen	13.6	12.9	12.3	12	13	12.2	13	12.2	15	12.1	12	11.8	12.7	14.3	15	13.8
Width at level of auditory apertures	37.2	35	35.3	36.5	37.7	35.6	36.9	34.1	36.7	36.7	36	37.7	36.3	37.3	36	37
Lateral length of braincase	33	34.6	33	34.6	36.5	33.5	36	33.8	35.5	34.9	34	35.3	34.6	34	32.3	32.6
Lateral length of facial part of skull	37.6	38	38.4	38.7	37.7	36	40	37.3	42.3	38.8	36	37	38.2	40.7	38.8	39
Length of bony palate	7	7.2	7	7.6	8	7.3	7.8	8.8	7.9	8	7	7.7	7.6	8	8.3	8.2
Width of incisive foramina	9.9	8.8	9.2	9.3	9.2	9	10	8	10.2	9.8	8	7.2	9.0	10	9.3	10
Length of incisive foramina	21.5	22	22.6	22.1	21.9	21	22.5	20	26.2	23.3	21.1	20.7	22.0	23	22.7	22
Length of zygomatic arch	38.5	39	39.3	38.7	39	35.2	36.2	37	41	38.2	37	36.3	38.0	38.2	38.2	38
Length of upper tooth row	17.3	17.5	18.2	18.3	17	17.3	18.9	17.2	18	17.6	17	16.2	17.5	19	18.3	18.9
Upper diastema	25.4	23.8	24	23.5	24.9	23	25.5	24	27.5	25.2	23	23.2	24.4	26.2	25	25
Length of body and head	—	—	—	—	—	440	—	—	—	—	515	504	486.3	540	500	554
Length of tail without terminal hair	—	—	—	—	—	49	—	—	—	—	68	50	65.7	85	85	88
Length of hind feet	—	—	—	—	—	132	—	—	—	—	152	144	142.7	155	145	150
Length of ear along concavity	—	—	—	—	—	77	—	—	—	—	92	84	84.3	83	85	88
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 27

Measurements of Lepus timidus Linn.

Subspecies	Lepus timidus gichiganus J. Allen											
	No.1047 ♀ 27 Jan. 1932. Markovo, on the Anadyr river. L.A. Portenko	No.1051 ♀ Mar. 1932. Ibidem	No.1053 ♀ Mar. 1932. Ibidem	No.1048 ♀ Mar. 1932. Ibidem	No.1045 ♂ 27 Jan. 1932. Ibidem	No.1949 ♀ Mar. 1932. Ibidem	No.1052. Spring 1932. Ibidem	No.1046. Spring 1932. Ibidem	No.1050 ♀ Mar. 1932. Ibidem	No.156 ♀ 6 July 1932. Estuary of Shchuch'ya river. L.A. Portenko	No.M.3174 ♂, 25 km south of Yakutsk. K. Vorob'eva	No.M.3172 ♀ 29 Sep. 1927. Mastokh-khaya, 25 km north of Yakutsk
Length of skull	97.2	98.3	95.3	95.8	95.2	95.2	95.6	95.4	95.3	95.2	91.2	96
Basal length of skull	75	77	76.8	75.3	75.3	78.3	74.2	75.2	73.2	74.2	72	76.5
Condylobasal length of skull	86	87.2	87.2	86.5	86	87.3	85.5	85.8	83.3	85	82.8	87.2
Zygomatic width	50	49.2	48.5	49.1	51.6	48.5	48.3	49	d.	49.1	48.2	50
Length of nasals	38.7	40.3	41.8	38.6	41.2	38.2	38.9	39.2	d.	40	36.3	39.9
Width of nasals	16.6	18.3	17.5	17	18.3	16.3	15.2	15	15.3	16.6	16.8	16
Width of nasal foramen	15.2	16.3	15	15	16.2	12.3	13.3	13.2	13.2	15.2	13.8	14.7
Width at level of auditory apertures	38.3	39	37.2	37.3	38.7	36.2	37	36.7	34.3	37	37	36.7
Lateral length of braincase	34.7	36	33.2	36	32.6	33.2	36	35.3	35	33.2	36.0	35.2
Lateral length of facial part of skull	40.2	41.2	40.8	41	41.3	42.2	39.3	40.6	39.3	41	37.5	40.2
Length of bony palate	8.3	7.2	8.2	7	6.3	8.2	7.2	8.1	7	6.7	7	7.3
Width of incisive foramina	8.8	11.1	9.3	9.3	10	10	10	8.3	10	10.2	9.1	9
Length of incisive foramina	23	24.9	21.8	24.2	23	22.6	23	22.3	22.2	23.2	21.8	23.6
Length of zygomatic arch	d.	40.2	40.5	41	38.7	41	38	40.5	38.6	42	37.8	41
Length of upper tooth row	18.5	19.2	18.2	19	18	19	18.2	17.2	18.2	19	17.8	18.2
Upper diastema	27.2	28.2	27	27.3	26.8	26.8	26.2	27	25	26.7	24	27.6
Length of body and head	—	—	—	—	—	—	—	—	—	—	541	500
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	148	145
Length of hind feet	—	—	—	—	—	—	—	—	—	—	88	83
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 28

Measurements of Lepus timidus Linn.

Subspecies	Lepus t. gichiganus		Lepus timidus subsp.		Lepus timidus mordeni Goodwin										
	No. 3175 ♂ 28 Sep. 1927. Kil'dettsy, 30 km north of Yakutsk. K. Vorob'eva	Lepus timidus gichiganus Allen. Average	No. M.3368 ♀ 30 May 1927. Delta of Taz river. R.E. Kol's	No. M.4497 ♀ Dec. 1921. Khel'mer Sede, Taz Delta, Kol's	No. M.4495 ♀ Dec. 1926. Ibidem	Lepus timidus subsp. Average	No. M.3176 ♀ 25 July 1925. Kureika river, tributary of Yenisei. Shillinger	No. M.3181 ♂ Jan. 1914. Vladivostok. A.I. Cherskii	No. M.3184 ♂ 8 June 1912. Valley of the Odarka, basin of Lake Khanka. A.I. Cherskii	No. M.3185 ♀ 9 Apr. 1911. Ibidem	No. M.3186 ♀ 29 May 1912. Vicinity of Nikolaevsk. Belousov	No. M.3179 ♂ Jan. 1914. Vicinity of Vladivostok. A.I. Cherskii	No. M.3098 ♀ Dec. 1914. Ibidem	No. M.3182 ♀ 18 Oct. 1924. Southwestern coast of Sea of Okhotsk, Litke Cape. Dul'keit	Lepus timidus mordeni. Average
Length of skull	92.2	94.7	98.3	96.7	98	96.6	93.3	94.2	96.5	96.9	94.7	91.5	90.5	88.5	93.2
Basal length of skull	71.3	74.3	78.2	74	75.3	75.2	73.2	73.8	74.2	76.2	74.9	70.5	72.8	68	72.9
Condylobasal length of skull	83	85.2	89.2	86	86.5	86.5	84.2	86	88.1	89.2	87.2	82.5	83	80	85.1
Zygomatic width	50	49.0	48.2	49	48	48.3	48.8	48.8	49.8	50	47.8	47.6	48.7	48.2	48.7
Length of nasals	37.9	38.7	42	35	34.8	37.2	37	41.8	40.9	41.8	39	38.6	40	32.8	39.2
Width of nasals	17	16.4	16.6	14.8	15.6	16.2	18	14	18.9	19.3	17.2	16	17.1	15	16.8
Width of nasal foramen	12.5	14.3	15.3	14	15.6	14.6	13.7	11.3	14.3	15	13.5	13.6	14.2	12.2	13.4
Width at level of auditory apertures	37.2	37.1	37.6	37.2	39.2	38.0	d.	37.3	38.6	38.7	d.	35.1	35.2	36	36.8
Lateral length of braincase	35.2	34.4	34.3	36.3	38.3	36.2	36	36.1	38	37.9	37.2	36.3	32.9	35.9	36.3
Lateral length of facial part of skull	39.9	40.2	41.6	40.2	40.7	40.2	38.3	40	41	44	40	40	39.1	36	40.0
Length of bony palate	7.8	7.6	7	7.3	9.2	7.7	7.2	8.2	7.3	7.3	8.1	7	7	8.2	7.6
Width of incisive foramina	10.2	9.7	10.2	9	9.3	9.8	10.9	9.9	10.1	11	9.3	11	10	9	10.0
Length of incisive foramina	21.3	22.8	23.6	23.2	23.3	23.0	22	24.2	23.4	24.5	23	22.6	22.3	20.1	22.9
Length of zygomatic arch	40.7	39.6	41	39.2	40.5	39.7	38.2	40.7	41.5	39.2	40	37.3	39.9	38	39.5
Length of upper tooth row	17.7	18.4	19	19	18.2	18.6	18.2	19	19.8	19.8	18.6	19.7	18.7	18.5	19.2
Upper diastema	25	26.3	27.2	26	27.2	26.2	24.2	24.7	25	27.2	27	24.2	24	21.7	24.8
Length of body and head	540	—	—	—	—	—	610	570	535	526	523	550	—	—	540.8
Length of tail without terminal hair	—	—	—	—	—	—	—	120	90	120	132	100	—	—	112.4
Length of hind feet	160	—	—	—	—	—	154	159	158	161	158	158	147	—	156.8
Length of ear along concavity	90	—	—	—	—	—	101	—	97	95	95	95	96	—	95.6
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 29

Measurements of Lepus timidus Linn.

Subspecies	Lepus timidus kolymensis Ogn.									Lepus timidus begitshevi Koljushev											
	No. S.1474, ♂ 4 May 1904. Nizhne Kolymsk. S.A. Buturlin	No. S.1475, ♂ 29 Apr. 1905. Nizhne Kolymsk. S.A. Buturlin	No. S.1473. Ibidem	No. 8073, 3 Sep. 1905. Kolyma Expedition. S.A. Buturlin	No. 8033, ♂ 4 June 1905. Pokhodskoe, near delta of Kolyma	No. 8028, ♀ 4 June 1905. Ibidem	No. 8036, ♀ 7 June 1905. Ibidem	No. 131, 3 June 1905. Ibidem	Average	No. 18768, 28 Aug. 1933. Eastern Taimyr, Balakhninskaya Cone-shaped Hill. Yakovlev, ZMAN collection	No. 18787, ♀ 30 May 1933. Coast of Khatanga Bay	No. 18786, ♀ 4 June 1933. Ibidem	No. 18766, ♀ 30 Aug. 1933. Eastern Taimyr, Balakhninskaya Cone-shaped Hill	No. 18771, ♂ 15 May 1933. Eastern Taimyr, 7 km from Cape Kargo. ZMAN collection	No. 18772, ♂ 27 June 1933. Bol'shaya Balakhnya River, Eastern Taimyr. ZMAN collection	No. 18769, ♂ 24 Aug. 1933. Balakhninskaya Cone-shaped Hill, Eastern Taimyr	No. 18770, ♂ 24 Aug. 1933. Ibidem	No. 18779, ♂ 25 Oct. 1934. Bol'shaya Balakhnya River, Eastern Taimyr	No. 18767, ♂ 18 Feb. 1933. Dudinskoe on Yenisei River. Yakovlev	L. t. begitshevi Koljush. Average
Length of skull	99.1	95.3	93.2	95.2	95.3	97	99.2	98.2	96.6	103	104.3	105.7	105.3	102	105.3	102	103.2	98	105.2	103.4
Basal length of skull	78	74.8	73.2	74.3	73.2	75.8	78.2	d.	75.4	81	80.3	83.2	82.2	81.5	81.3	78.8	77.7	76	82.3	80.4
Condylobasal length of skull	90	87.8	84.2	86.3	85.8	87.8	90.8	d.	87.5	94.2	94	94	94.2	92.3	93.2	91.3	90	88	95.2	92.6
Zygomatic width	48.7	48.7	49.2	47.7	d.	50.3	49.6	51	49.3	54	53.8	53.8	51.6	52.3	53.5	54	51.6	50.6	52	52.7
Length of nasals	40	36.6	36.3	38	38	41.3	39.9	41.1	38.9	43.2	41.5	44.3	42.3	43.3	45	40.7	41.3	43.5	43.3	42.8
Width of nasals	15.8	16.2	16.9	—	—	—	—	—	16.3	21.2	20.2	21.2	21.2	19	21.3	20.2	19.3	19	20.3	20.3
Width of nasal foramen	13.1	14	14.9	—	—	—	—	—	14.0	22	18.5	17.2	16.7	18	18.5	18	17.2	16.5	16.3	17.9
Width at level of auditory apertures	39.2	37.1	38	d.	d.	39	d.	d.	38.3	41.5	40.3	40.2	38.3	40.6	39.2	39.6	39.3	39	39.3	39.7
Lateral length of braincase	36	34.3	37.1	36.2	37.1	38.9	40	34.5	36.8	37.2	38.2	38.7	38	36	37.3	37	37.6	35.2	37.5	37.2
Lateral length of facial part of skull	43	40	40	40	—	—	—	—	41.0	45.2	46	45.6	45.3	45	46	44.2	44	44	44.9	45.0
Length of bony palate	8.1	8.1	7.1	7.7	6.7	6.3	8.2	7.2	7.4	8.9	8.3	6.6	7.7	8.6	7	7.5	8	8.8	8.2	8.0
Width of incisive foramina	9.6	10.7	10	9.9	9.8	10.9	10.3	11.5	10.3	12.2	11	11.3	11.4	9.2	13.2	12.3	10.6	10	10.2	11.1
Length of incisive foramina	24.9	24	23	24.3	—	26	25	24.8	24.6	24.2	24.6	25.5	24.2	24.2	25.3	25	25	22.6	25.6	24.6
Length of zygomatic arch	39	38.5	38.2	40.7	d.	41.8	42.1	40.7	40.1	45.9	43.9	42.4	43.3	42.4	46.3	44	43.8	39.8	43.6	43.5
Length of upper tooth row	19.5	19	18	18.9	19.1	18.7	19.9	19.8	19.1	19	19.2	20	19.9	19.2	20	20.5	18.6	19	20	19.5
Upper diastema	28.2	26	25.2	—	—	—	—	—	26.5	30	30.2	30.6	29.4	30	32	29.2	30.2	27.6	29	29.8
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	740	740.0
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	75	75.0
Length of hind feet	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	160	160.0
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	83	83.0
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 30

Measurements of Lepus timidus Linn.

Subspecies	Lepus timidus tschuktschorum Nordquist										
	No. M.4346, 1934. Chukot Peninsula, Mechigmen Bay. E. V. Schmidt	No. M.4345, 1934. Ibidem	No. M.4342, 1934. Ibidem	No. M.4344, 1934. Ibidem	No. M.4343, 1934. Ibidem	No. 128 ♀ 9 July 1934, Chukot Peninsula, middle reaches of Ushie Ukheli river. P. A. Portenko	No. 216 ♀ 23 Jan. 1934. Yararmuleny river, northeastern part of Chukot Peninsula	No. 40 ♀ 15 Feb. 1934. Yararmuleny river, tributary of Utte vil' river	No. 212 ♂ 17 Jan. 1934. Utte Vil' river, eastern part of the Chukot Peninsula	No. 215 ♀. Yararmuleny river, tributary of Utte Vil'	Lepus timidus tschuktschorum. Average
Length of skull	106	103.7	104.3	101.8	102	106.1	102.2	98.2	103.2	102.6	103.0
Basal length of skull	84	82.8	81	80	80	83.2	81.3	78	81	80	81.1
Condylobasal length of skull	94.8	94.2	91.6	91.3	91.3	94.2	92	88.8	93.2	91.5	92.3
Zygomatic width	54.5	52	d.	52.6	51.5	54.2	52.3	51.6	53	53.6	52.8
Length of nasals	42.9	39.8	41.5	39.2	40.2	44.9	41.5	39.2	41.6	42.3	41.3
Width of nasals	22.3	19.2	18.2	18.6	19.1	18.3	17	19.6	21	17.2	19.0
Width of nasal foramen	18	16	16.3	16.7	17.2	14.5	15.9	17.8	19.2	17.8	16.9
Width at level of auditory apertures	39.2	39.6	37.2	38.2	38.7	39.5	38.9	36.6	40	38	38.6
Lateral length of braincase	39.9	39.2	38	36	36.6	37.1	37.2	35.5	37.8	38	37.5
Lateral length of facial part of skull	45.2	44.8	44.6	43.2	42.5	47	44.6	42.7	44.2	43.2	44.2
Length of bony palate	7.3	8.6	8	8	7.3	8.3	9.5	8.2	7.2	7.3	8.0
Width of incisive foramina	11	11.1	10	9.5	10.3	12.2	10.2	10.2	11	11.3	10.7
Length of incisive foramina	26.1	27.1	26	26	24.5	26.5	26.1	24.7	26.3	26.2	26.0
Length of zygomatic arch	45.1	42.2	42.8	43	42	43.3	43.3	41.5	d.	41.2	42.7
Length of upper tooth row	19.6	19.8	20.1	20	19	20.5	19.7	19.6	19.2	19.2	19.7
Upper diastema	31	30	30	30.2	28.5	31.7	29.3	28	30.3	30	29.9
Length of body and head	—	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet	—	—	—	—	—	—	—	—	—	—	—
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	—	—	—	—	—	—	—	—	—	—	—

TABLE 31

Measurements of Oryctolagus cuniculus L.

Subspecies	Oryctolagus cuniculus cuniculus Linn.						
	No. S. 3315, Kalisz Province. Collection of Moscow State Zoological Museum	No. S. 3319, Ibidem	No. S. 3314, Ibidem	No. S. 3313, Ibidem	No. S. 3317, Ibidem	No. S. 3318, Ibidem	Average
Length of skull	79	78.3	77.3	76.3	81	76.7	78.1
Basal length of skull	60	61	58.7	59	62.1	58	59.8
Condylobasal length of skull	70	69.7	68	68	72.2	67.8	69.3
Zygomatic width	39	38.2	38.3	37.1	37.7	36	37.7
Length of nasals	36	36	36.3	35.7	37.6	33.1	35.8
Width of nasals	11.8	12	11.8	12.6	11.6	11.6	11.9
Width of nasal foramen	7.2	8	7	7.7	8	7.1	7.5
Width at level of auditory apertures	30.8	31.6	32.6	30.2	29.5	29.6	30.7
Lateral length of braincase	30.2	30	29.8	28.2	30	29.2	29.6
Lateral length of facial part of skull	32.3	33.2	32.9	33	35	32.2	33.1
Length of bony palate	6.9	7	6.1	6.3	7	6.7	6.7
Width of incisive foramina	7	7.7	⟍6.7	7.2	7	6.8	7.1
Length of incisive foramina	18.1	20	19	18.5	21.8	18	19.2
Length of zygomatic arch	32.2	34	33	32.7	33.7	32.1	33.0
Length of upper tooth row	13.2	13.5	13.8	13.3	14.2	13	13.5
Upper diastema	21	21.6	21.8	21.3	23	21.3	21.6
Length of body and head	—	—	—	—	—	—	—
Length of tail without terminal hair	—	—	—	—	—	—	—
Length of hind feet	~95	~90	—	85	96	91	91.4
Length of ear along concavity	—	—	—	—	—	—	—
Length of ear from occiput	~68	67	~60	72	~75	~70	68.7

TABLE 32

Measurements of Allolagus mandshuricus Radde

Subspecies	Allolagus mandschuricus mandschuricus Radde														
	No. M.3072 ♀ 18 May 1914. Sea of Japan. Vostok Bay, inlet of Tikhaya Zavod. A.I. Cherskii	No. M.3074 ♂ 7 Feb. 1914. Estuary of Suifun river, Amur Bay	No. M.3073 ♂ Jan. 1914. Ibidem	No. M.3075 ♀ 1 Mar. 1914. Vladivostok (bought in the market)	No. M.3078 ♀ Feb. 1914. Ibidem	No. M.3076 ♀ 8 Feb. 1914. Estuary of Suifun river, Amur Bay	No. M.3080 ♂ Jan. 1914. Bought in the market in Vladivostok	No. M.3070 ♀ 22 Nov. 1913. Okeanskaya railway station, Maritime Territory	No. M.3077 ♂ Jan. 1914. Bought in the market in Vladivostok	No. M.3069 ♀ 2 May 1914. Peter the Great Bay	No. M.3071, 5 Feb. 1914. Estuary of Suifun river,	No. M.3079 ♂ 21 Dec. 1914. Bought in the market in Vladivostok	No. M.3081 ♀ Jan. 1914. Ibidem	No. S.4037, Oct/Nov. 1908. Sikhote-Alin, Sol'skii Village Bogomolov	Allolagus mandschuricus. Average
Length of skull	87.2	87.4	86	82.1	86.2	82.2	d.	89	88.1	87.9	83.6	84.5	82.9	83.2	85.4
Basal length of skull	66.5	68	66	65	66.2	64.9	d.	69.8	67.2	69.6	65	64.2	62.9	64.2	66.1
Condylobasal length of skull	78.7	79.6	76.2	75.4	77.5	75.4	d.	81.1	77.7	79.8	76	76	74.2	74.9	77.1
Zygomatic width	44	42.8	42	41.6	40	42	42.1	42.5	41.3	43.7	40	40	42.3	41.9	41.9
Length of nasals	36	36.5	35	35.1	35.8	34.7	34.3	37.9	37.4	36.8	34.8	35.2	32.8	34.9	35.5
Width of nasals	15.8	15.8	16.2	15	15	16	14	16.3	17	18	15.7	16	14.5	14.2	15.7
Width of nasal foramen	8.5	9	8.8	10	9	7	7.8	9.2	9.8	10	8.3	10.2	9.1	8.1	8.9
Width at level of auditory apertures	33.1	33.6	d.	33.2	32.5	32.5	d.	34.9	34	34	32.3	32.8	32	31.5	33.0
Lateral length of braincase	32	32.7	32.9	31.2	32.6	32.3	d.	33	32.3	32.1	32.8	32.6	32.9	32	32.4
Lateral length of facial part of skull	35.3	36.3	35.1	34.7	36.9	33.7	34.5	37	37	37.6	35.2	35	34.2	34	35.5
Length of bony palate	8.9	9.2	9.2	7.3	7.8	8	9.2	8.8	9	8	8.2	8.6	7.9	8	8.4
Width of incisive foramina	9.5	9	9.9	8.2	9.2	8.6	8	9	9.2	9.2	d.	8.3	9.1	7.2	8.8
Length of incisive foramina	20	20.3	19.3	19.2	21.5	20.1	20	22	20.5	21.8	20.3	20.7	20	20	20.4
Length of zygomatic arch	36.2	38.2	36.5	38	d.	37.3	36	40	35.2	37	37	38.8	35.2	35.7	37.0
Length of upper tooth row	18.3	17.9	17.7	17.9	17.2	17.1	17	17.3	17.2	17.7	17.7	17.1	17.3	17.3	17.5
Upper diastema	20.2	21.7	21.1	20.7	23.8	21.4	22.7	23	22.8	23	21.3	21.2	20.9	20.7	21.8
Length of body and head	440	540	495	—	—	510	455	430	470	475	420	—	500	—	473.5
Length of tail without terminal hair	100	115	102	—	—	120	120	110	100	110	—	—	160	—	115.2
Length of hind feet	125	129	129	117	121	120	120	125	130	126	124	120	118	—	123.4
Length of ear along concavity	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear from occiput	89.2	89	95	84	89	85	89	88.5	90	90	89	93	85	—	88.9
Weight	—	2 kg	1656 g	—	—	1832 g	—	2100 g	—	2600 g	1852 g	—	a form of melanonotus		2006.7 g

TABLE 33

Measurements of Pteromys volans Linn.

Subspecies	Pteromys volans volans L.											Pteromys volans gubari Ogn.						Pteromys v. betulinus Serebr. (Typus)
	No. M.3877 ♂ 29 Aug. 1931. Sheksna River, above Rybinsk. P. G. Kaplanov and V. Raevskii	♂ ad. 11 Oct. 1914. Verbilki, Dmitrov County, Moscow Province. V. G. Durov. ZMMU collection	♀ 25 Nov. 1925. Nizhni Novgorod Province, bank of Vetluga river, former Semenov County. L. Girshfel'd	Sex. r. 10 Feb. 1929. Mozhga Subdistrict, former Yelabuga County, Kazan Province	♂ sen. 14 June 1930. Ponazyrevo Station, former Vetluga County, Kostroma Province. A. Formozov	♂ sen. 18 Nov. 1930. Vicinity of Kiselevo Village, Sharya District, former Vetluga County, Kostroma Province. A. Formozov	No. 2 ♂ ad. 25 Feb. 1929. Votsk Region, former Yelabuga County, Kazan Province. A. Formozov	♀ ad. Oct. 1929. Ibidem. A. Formozov	No. 3450 sex. Jan. 1901. Near Veimar station, Yamburg [Kingisepp] County, Peterburg Province. ZMMU collection	♂ ad. 1927. Verkhne-Uralsk. Zisser	Pteromus volans volans L. Average	No. 45 ♀ end of Dec. 1930. Troitskoe Village, West Siberian Territory (former Bisk County). V. Gubar'	♀ Dec. 1930. Ibidem. V. Gubar'	♂ end of Feb. 1931. Petrovka Village, Troitskoe District, former Bisk County, Tomsk Province	♀ 6 Sep. 1936. Korostelevskoe forestry, Rubtsovsk District (former Barnaul County)	♀ 23 Sep. 1927. Vicinity of Novosibirsk. V. V. Gubar'	Pteromys volans gubari sbsp. nov. Average	No. 18013 ♂ 8 Aug. 1928. Pavlodar County, Semipalatinsk Province. A. Dobrynin
Length of body and head	172	149	—	—	170	157	170	170	—	165	164,7	140,5	171	164	165,5	135,5	155,3	170
Length of tail without terminal hair	125	98	—	—	111	130	107	114	—	107	113,1	117	112	140	118,5	109	119,3	122
Length of hind feet	37	34,5	—	—	36	39	32	37	—	—	35,9	33	35	35	34	39,3	35,3	38
Length of ear	19	17,8	—	—	19	21	19	18	—	—	19,0	17	17	—	25,5	17	19,1	21
Length of skull	39,2	41	39,1	39,9	40,5	41,3	40,1	40	38,2	39,9	39,9	—	40	39,2	40,7	41	40,2	41
Basal length of skull	30,7	30,3	d.	30,3	32,5	31,2	31,1	30,7	29,5	30,7	30,8	30,8	31,2	31,9	—	d.	31,3	31
Condylobasal length	36,2	36,8	d.	36,2	37,2	37,8	36,2	36	34,9	36,3	36,4	35,7	36,9	36,8	—	d.	36,5	36,7
Maximum width	19,7	19	d.	19,1	19,3	19,5	19,2	18,9	18,1	19	19,1	19,2	18,9	18	[?],2	d.	18,8	20,9
Interorbital space	9,1	9,3	9,3	9,9	10	9	10,1	9,2	9,7	10	9,6	9,7	9,8	9,7	10,2	10,1	9,9	9,8
Zygomatic width	24	24,7	22,8	23,7	25,2	24,2	24,1	23,4	23,4	24,7	24,0	24	23,2	23,7	24,5	d.	23,8	25,4
Height at level of bullae osseae	16	16,2	16,8	16,1	16,5	17	16,2	17	15,2	16,1	16,3	—	16,3	—	16,2	d.	16,2	16,7
Height of bony palate	9,8	9,3	9,7	9,4	9,5	9,9	9,1	9,2	8,6	9,9	9,4	9	10	8,2	10	9	9,2	10,1
Length of nasals	12,2	12,8	11,9	12,6	12,2	13	12,1	12,5	11,9	12	12,3	—	12,1	12,1	13,1	12,6	12,5	12,5
Length of braincase	22,3	23,2	22,3	23,2	23,6	23,5	23,2	23	20,5	22,7	22,8	21,8	22,5	21,6	—	d.	22,0	22,9
Width of rostrum	6,3	6,7	d.	6,1	6,8	6,9	6,7	6,2	6,2	6,2	6,4	6,1	6,1	6	6,6	6,8	6,3	6,3
Width of skull between infraorbital foramina	d.	—	d.	6,2	6,2	6,1	6,2	6,2	6,5	6,1	6,2	6,1	6	6,2	6,5	6,1	6,2	6,7
Length of bullae osseae	10,7	11,9	10,8	11	11	11	10,6	10,7	10,3	11	10,9	10,7	10,9	11,1	11,2	d.	11,0	10,9
Width of bullae osseae	7,1	8,8	7	7,9	7	7,2	7,3	6,9	7,8	6,9	7,4	7	7,1	7,2	7,9	d.	7,3	8
Length of upper tooth row	7,1	7,2	7,6	7,6	7,1	7,1	7,1	7,2	7,1	7,7	7,3	7,2	7	7,3	7,2	7,5	7,2	7,2
Length of lower tooth row	6,9	7	7,2	7	7	7	7	7	6,5	7,2	7,0	7	—	7,1	7,3	7	7,1	7,2
Weight	—	—	—	—	133 g	142 g	—	—	—	—	137,5 g	—	—	—	—	—	—	—
																		Pteromys v. betulinus serebr. (Typus)

TABLE 34

Measurements of Pteromys volans Linn.

Subspecies	Pteromys volans betulinus Serebr.								Pteromys volans turovi Ogn.									
	No. 30 ♂ 4 Nov. 1930. Srostinskii pine forest, former Zmeinogorsk County, Tomsk Province. G. K. Gol'tsmaier	No. 168 ♂ 1/3 Jan. 1931. Ibidem	No. 25 ♀ 22 Oct. 1930. Ibidem	No. 170 ♂ 1/3 Jan. 1931. Ibidem	No. 308 ♂ 20 May 1931. Ibidem	No. 417 ♂ Subad 25 Aug. 1931. Ibidem	No. 416 ♀ 25 Aug. 1931. Ibidem	No. 257 ♀ 15-28 Feb. 1931. Ibidem	Pteromys volans betulinus Serebr. Average	No. M.1241, 6 Oct. 1923. Baikal, Koty Peninsula. V. Ch. Dorogostaiskii	♀ Vicinity of Argaty, 12 Jan. 1931. Bank of Bukhtarma river 12.80 m. Datsenko	♀ Oct. 1927. Eastern Sayan Mountains. M. A. Sergeev	No. 2 ♀ Oct. 1927. Ibidem	No. 3 ♀ Oct. 1927. Ibidem	♀ 21 July 1928. Sretensk District, Transbaikalia. B. A. Kuznetsov	No. 14 ♀ 7 Oct. 1932. Khor river, tributary of Ussuri river. A. Pronin	No. 11-5 ♀ 6 Oct. 1932. Khor river, vicinity of Bichevaya, Amur Territory. A. Pronin
Length of body and head	156.4	159.2	172.9	153.6	160	116	161.6	163.9	157.1	—	—	—	—	—	172	138	137.7
Length of tail without terminal hair	114.9	113.8	d.	98.3	101.8	119.6	117.3	116.4	113.0	—	—	—	—	—	98	100	106
Length of hind feet	35.6	34.1	39.8	35.1	34.1	35	35.8	34.9	35.8	—	—	—	—	—	36.2	32	34
Length of ear	19.1	17.8	17.9	16.1	18.4	19.4	19.4	20.1	18.8	—	—	—	—	—	19.4	20	20
Length of skull	40.2	39.2	41	41	39.3	39.2	41.3	41.2	40.4	39.1	40.9	39.3	41.1	40.1	39.2	—	—
Basal length of skull	31.2	31.3	32.3	30.3	30.1	29.6	31.1	31.2	30.9	29.2	31.5	29	31.6	30	30	—	—
Condylobasal length	36.6	37	37.1	36.6	36	35	36.9	37.3	36.6	35.1	37.3	35	37.6	36.6	31.2	—	—
Maximum width	19	20.2	19.2	d.	19.1	18.9	19.2	19.3	19.5	18.8	19.2	19.7	19.1	18.8	19.4	—	—
Interorbital space	9.8	9.9	9.6	10.1	9.9	8.8	8.9	9.7	9.6	8.9	10.8	8.8	8.8	10	9	—	—
Zygomatic width	24	24	25	23.5	24	22.9	23.8	24	24.1	24.1	24	22.9	23	22.2	23.2	—	—
Height at level of bullae osseae	16.1	16.6	17.1	16.5	16.2	16	16.3	16	16.4	16.1	16	16.7	16	16.3	16.7	—	—
Height of bony palate	10	10.1	9.9	9.6	9.2	9	9.6	9.9	9.7	8.7	8.8	9.9	9.3	10	9	—	—
Length of nasals	12.5	d.	13	12.6	12	12	13.1	12.3	12.5	12.5	12.5	12	13	12	12.2	—	—
Length of braincase	23.1	23.1	23	22.2	22.8	22.1	23.3	23.1	22.8	23.1	22.8	23	23.2	22.1	22.3	—	—
Width of rostrum	6	6.2	6.3	6.5	6.3	6	6.3	6.2	6.2	6.1	6.6	6	6	6	6.1	—	—
Width of skull between infraorbital foramina	6.2	6.2	6.6	6.1	6	6.2	6.3	6	6.2	6	6.1	7	6.8	6.1	6.1	—	—
Length of bullae osseae	11.2	11	10.9	10.2	10.3	10.3	10.8	10.6	10.7	10.1	11.2	11	11.6	11	11.2	—	—
Width of bullae osseae	7.9	8.2	8	8.1	7.1	7	7.6	7.3	7.7	7	8	7	7.2	7.4	7.2	—	—
Length of upper tooth row	7.3	7.1	7.1	7	7.3	7.2	7.2	7.3	7.2	7	7.3	7.7	7.3	7.2	7	—	—
Length of lower tooth row	7.2	7	7.1	7	7.1	7	7.2	7.2	7.1	7	7.2	7.2	7.3	7.2	—	—	—

TABLE 35

Measurements of Pteromys volans Linn.

Subspecies	Pteromys volans turovi Ogn.					Pteromys volans athene Thos.										Pteromys v. incanus Miller		
	No. 14991 ♂ 14 Feb. 1927. Altai, upper reaches of Bukhtarma River, Berel' Village, Dotsenko. ZMAN collection	No. 14992 ♀ 14 Feb. 1927. Ibidem. ZMAN collection	No. 3757. Altai. Plotnikov. ZMAN collection	No. M.1715 ♀ ad. 17 Feb. 1936. Near village Mondy, 25 versts north of Lake Hӧbsӧgӧl	Pteromys volans turovi Ogn. Average	No. M.3878, 1932. Sakhalin Island. A. Rekst	No. M.3879. Ibidem	No. M.3880 Subad. Ibidem	♀ ad. Korsakovskii Post [Korsakov], Sakhalin. ZMMU collection	No. 3727 Sakhalin. Suprunenko. ZMAN collection	No. M.2133 ♂ 9 Mar. 1926. Yakshina river, Bol'shoi Shantar Island. G. Dul'keit	No. 119 sex ? Jan. 1926. Upper reaches of Srednyaya river, Bol'shoi Shantar Island. G. Dul'keit	No. 647 sex ? Jan. 1926. Lake Bol'shoe, Bol'shoi Shantar Island. G. Dul'keit	No. 1245. Chulikan village. Nikolaevsk. A. Baturin	Pteromys volans athene Thos. Average	No. 16849 ♀ 10 Oct. 1927. Vicinity of Baikit along Lower Tunguska river. ZMAN collection	No. 15355 ♂ 3 July 1926. Namskii District, Ylbyt, Yakutia. ZMAN collection	No. 17705. 22 Apr. 1928. Kharyntsy Locality, 11 km from Yakutsk. ZMAN collection
Length of body and head	—	—	—	170	154.4	—	—	—	157	—	—	169	—	—	163.0	180	180	161
Length of tail without terminal hair	—	—	—	110	103.5	—	—	—	117	—	—	127	—	—	122.0	100	130	141
Length of hind feet	—	—	—	30	33.0	—	—	—	37.2	—	—	37	—	—	37.1	35	35	31
Length of ear	—	—	—	15	18.6	—	—	—	21.2	—	—	18	—	—	19.6	20	20	16
Length of skull	41	40.9	38.7	40	40.0	40.9	41.2	40.2	39.3	40.9	~41	42.2	~40.5	—	40.8	—	—	—
Basal length of skull	30.6	31.5	30.1	30.1	30.4	31.1	30	31.7	31	d.	31.8	31.3	31.2	—	31.2	—	—	—
Condylobasal length	36.2	36.8	35.6	36.7	35.8	36.9	36.3	37	36.2	d.	37.8	38.2	37.1	—	37.1	—	—	—
Maximum width	20.6	19.8	19.3	19	19.4	19.5	19.5	18.3	19.2	19.2	19.6	20	19	—	19.3	—	—	—
Interorbital space	10.3	9.8	9.5	9.6	9.6	8	8.9	8.8	8.3	8.3	10	9.5	8.7	9	8.8	—	—	—
Zygomatic width	24.7	24.5	23.6	24.6	23.7	23.6	23.7	23.1	23	24.2	24.1	25.2	23.7	23.1	23.7	—	—	—
Height at level of bullae osseae	17.2	16	16.1	17	16.4	16.6	17.2	17	16.7	d.	15.9	17.3	16.3	d.	16.7	—	—	—
Height of bony palate	9.6	9.1	9.6	9.1	9.3	10.1	9.2	8.3	9.9	9.1	9.7	9.3	8.9	8.8	9.2	—	—	—
Length of nasals	12.7	12.2	12.1	12.7	12.4	12.2	12.5	12.3	12.3	13.7	d.	13	d.	13.2	12.7	—	—	—
Length of braincase	23	22.2	22.2	d.	22.5	24	24.1	24.1	22.5	d.	23	24	23	d.	23.5	—	—	—
Width of rostrum	6.6	6.3	6	6.3	6.2	6.1	6.5	6	6.1	6.1	6.8	7	6.7	7.1	6.5	—	—	—
Width of skull between infraorbital foramina	6.7	6.1	6.2	6	6.3	6.2	6.5	6.2	6.7	6.7	6.1	6.2	6.2	6.3	6.3	—	—	—
Length of bullae osseae	10.2	11.1	10.9	10.8	10.9	11.7	11.2	10.4	11	d.	11	11.1	10.7	d.	11.0	—	—	—
Width of bullae osseae	7.6	7.2	7.3	9	7.5	7.6	7.2	6.2	7	d.	8.3	9.1	8	d.	7.8	—	—	—
Length of upper tooth row	7.3	7	7.2	7	7.2	7.3	7.3	7.3	7.3	7.1	7.2	7	7.1	7.1	7.2	—	—	—
Length of lower tooth row	7.2	7.1	7.1	7	7.1	7.2	7.1	7	7.2	7.3	7.1	7.1	7.3	7.1	7.2	—	—	—

TABLE 36

Measurements of Pteromys volans Linn.

Subspecies	Pteromys volans incanus Miller								Pteromys volans anadyrensis Ognev								P.v.arsenjevi Ogn.	P. v. athene Thos.
	No. 15714 ♀ 4 Jan. 1927. Kerulen river, at confluence with Aldan, 50 versts from the estuary. Yakutia. ZMAN collection	No. 15353 ♀ 18 June 1925. Seregyakh, vicinity of Yakutsk. ZMAN collection	No. 7428, 1892. Verkhne-Kolymsk. I. D. Cherskii. ZMAN collection	No. 7420 ♂ Ibidem	No. 7421 ♂ Ibidem.	No. 7418 Ibidem	No. 131 ♂ 25 Feb. 1927. Khayakhta, vicinity of Verkhoyansk, valley of Yasa river. ZMAN collection	No. M.2210 ♂ Sen. 6 Nov. 1927. Ravine of the Vilyui near Yakutsk. K. E. Vorob'eva	No. 4747. Anadyr Territory. N. P. Sokol'nikov. ZMMU collection	No. 4748 Ibidem	No. 60 (1934) — 797 ♀ sen. 1932. Yeropol, Anadyr Territory. L. A. Partenko	No. 60 — 1934 (798) ♀ sen., Feb. 1932. Ibidem	No. 60 — 1934 (799) ♀ Feb. 1932. Ibidem	No. 60 — 1934 (796) ♀ Feb. 1932.	Pteromys volans incanus. Average	Pteromys volans anadyrensis. Average	No. 514 (10) 1 Nov. 1908. Ussuri Territory. V. K. Arsen'ev. ZMAN collection	No. 102-1914 ♀ 20 Jan. 1913. Minai near Hokkaido, Japan. ZMAN collection
Length of body and head	165	176	—	—	—	—	—	—	—	—	207	170	175	195	172.5	171	—	—
Length of tail without terminal hair	136	111	—	—	—	—	—	—	—	—	98	100	110	95	123.6	98.2	—	—
Length of hind feet	38	32	—	—	—	—	—	—	—	—	35	35	36	37	34.2	35.7	—	—
Length of ear	16	18	—	—	—	—	—	—	—	—	16	16	18	15	18	16.2	—	—
Length of skull	—	—	41.3	41.1	41.6	41.0	40.1	41	d.	37.7	41.6	42.2	41.8	d.	41	40.75	38.3	39
Basal length of skull	—	—	32.2	31.3	31.7	32	31.3	31.3	d.	30.2	32	32.3	32.1	d.	31.66	31.5	31.3	31
Condylobasal length	—	—	38.7	37.5	38	38	37.1	37.7	d.	34.8	38.2	38.3	38	d.	37.83	37.2	36	35.3
Maximum width	—	—	22	20.2	20.2	25	20	20.3	d.	d.	20.1	20.8	21.1	d.	21.3	20.66	20.3	19.1
Interorbital space	—	—	10	9.2	10.6	10.2	10	9.8	8.8	9.3	10.1	10.3	9.6	d.	9.83	9.75	8.8	8.2
Zygomatic width	—	—	25.2	25.6	24.6	24.7	25	25.1	d.	23	25.7	25.5	25.3	d.	25	24.7	d.	23.5
Height at level of bullae osseae	—	—	17	16.6	16.7	17.2	16.3	16.2	d.	14.7	16	17.2	17.1	d.	16.6	16.2	16.7	15.9
Height of bony palate	—	—	9.2	10.2	10.1	10.1	9.6	9.1	9.2	9.2	8.6	9.6	9.6	d.	9.66	9.2	9.7	9.9
Length of nasals	—	—	12.9	12.9	11.1	13.6	12.6	13.3	13.1	12.3	13	14	13.2	13.3	12.66	13.2	12.1	12.9
Length of braincase	—	—	23.6	23.3	24	23.1	22.6	23	d.	21.1	22.1	23.7	23	—	23.1	22.5	22	22.9
Width of rostrum	—	—	7	6.9	6.9	6.6	6.8	7	6.7	6	6.6	6.9	6.6	6.9	6.83	6.6	6.3	6.3
Width of skull between infraorbital foramina	—	—	6.6	6.6	7	6.9	7.5	7	d.	6	6.3	7	7	7	6.83	6.6	7	6.7
Length of bullae osseae	—	—	11.3	11.1	11.1	11	10.2	11.3	d.	10.7	11	12	11	d.	11	11	11.1	10.9
Width of bullae osseae	—	—	8	8.3	8.2	8.2	6.8	7.2	d.	7	8.6	8.2	8.8	—	7.66	8.1	8	8
Length of upper tooth row	—	—	7.2	7.3	7.2	7.7	7.3	7.7	7.7	7.3	7.5	7.6	8	8	7.6	7.6	7.2	7.2
Length of lower tooth row	—	—	7.3	7.5	7.2	—	7.2	7.3	7.8	7	7.2	7.8	7.6	8.1	7.2	7.4	7.2	7.1

TABLE 37

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris ognevi Migulin															
	No. M.1278 ♀ 14 Oct. 1921. Sergievski Posad [Zagorsk], Moscow Region. S. I. Ognev	No. M.1285 ♂ 12 Sep. 1912. Moscow County (from Aleksandrov)	No. M.1281 ♀ 4 Apr. 1921. Dmitrov District, Moscow Region. S. I. Ognev	No. M.1282 ♂ 15 Apr. 1911. Tesovskii Imperial Estate Forest, Mozhaisk County, Moscow Province. S. I. Ognev	No. M.1288 ♀ 19 Nov. 1922. Mytishchi, Moscow Region. B. Tserevitinov	No. M.1291 ♀ 22 Oct. 1922. Izmailovskii Zverinets,* near Moscow	No. M.1289, 22 Oct. 1922. Ibidem	No. M.1279 ♀ Ibidem	No. M.168, 24 Nov. 1923. Dmitrov County, Moscow Province	No. M.169, 24 Nov. 1923. Ibidem. O. A. Kharuzin	No. M.2142 ♀ 14 Mar. 1914. Ibidem. S. I. Ognev	No. M.1290 ♂ 9 Nov. 1922. Izmailovskii Zverinets,* near Moscow	No. M.3774 ♂ 21 Aug. 1922. Moscow County. K. K. Flerov	No. S.2630 ♀ 14 Sep. 1912. Petrovsko-Razumovskoe, near Moscow	No. S.5864, [illegible] Oct. 1923. Balashikha, near Moscow. P. A. Portenko	No. S.5863 ♂ Feb. 1923. Losinyi Ostrov, near Moscow. K. K. Flerov
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet without claws	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of skull	52.2	52.2	51.1	51	51.3	51.1	51.1	51.7	51	47.2	53.2	50	48.6	51.5	51.7	50.1
Basal length of skull	40.8	40.7	40.7	40.6	40.3	40.1	39.6	40	41.2	37	d.	38.3	36.9	39	43	d.
Condylobasal length of skull	46.9	47.2	46.7	46.3	46.2	47	46.6	46.2	47.3	43.6	47.8	45	42.8	45	49.2	47
Maximum width	24.3	24	24.8	22.7	23.2	23.5	24.3	23.3	23.3	21.4	d.	23	21.3	23.7	25.3	24
Interorbital space	21	19	19.6	19.3	19	19.2	19.8	17.9	18.2	17.2	18.6	18	16.3	19.9	20.6	17.2
Zygomatic width	32.6	32.6	31.9	31.7	30.2	32.1	32.1	29.8	31.2	30	32.2	30	29.3	33.2	32.5	32.2
Height at level of bullae osseae	21.6	23.2	22.2	22.1	22.	21.5	22.4	22.1	23.3	21	d.	21.7	22.2	22.2	22.2	21.8
Height in region of bony palate	15.2	13.6	14.2	14.3	14	14.1	14.3	14	14.1	13.3	13.3	13.3	13.2	14.3	14	14.2
Length of nasals	16.2	16.5	15.1	15.7	15.2	16	15	15.6	16	13.8	15.2	14.7	15.1	15.3	16	14.8
Length of braincase	27.9	29.1	27.2	28.2	26.5	28.1	27.5	27.7	27.3	27	d.	27.7	27.2	27.9	27.3	27.8
Width of rostrum	9.4	9.6	9.6	9.7	8.7	9.9	9.1	9	8.4	9	9.8	8	8.3	9.9	9.9	9.1
Length of bullae osseae	10.6	11.3	10.2	11	10.8	10.6	10.2	11.1	11.1	10.1	11.1	11	10.2	10.2	10	10.8
Width of bullae osseae	8.6	8.2	8.2	8.6	8.1	8	8.3	7.2	7.7	7.5	8.5	7.8	7.3	8.3	8.	8.2
Upper tooth row	9.2	9.8	8.4	9	9.6	9.2	8.9	9	9.2	9.1	8.3	9.3	9.1	9.2	8.6	8.9
Lower tooth row	9	9.2	9	8.2	8.7	9.2	8.9	8.7	9.1	9	9.1	9.3	9	9.1	8.3	8.8
Width of skull between infraorbital foramina	10	9.5	10.1	10.1	9.4	10.4	10.3	9.2	10.1	10.2	10	10	9.6	10.3	9.9	10.2
Age, years	4	1	5	4	1	1	1	2	1	2	3	1	1	~5	>6	3

* [Hunting Area.]

TABLE 38

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris ognevi Migulin															
	No. S. 2634 ♂ 2 Oct. 1912. Petrovsko-Razumovskoe, near Moscow	No. S. 2382 ♀ 21 Dec. 1911. Ibidem	No. S. 2372 ♀ 9 Nov. 1911. Ibidem	No. S. 2383 ♀ 7 Dec. 1911. Ibidem	No. S. 2636 ♂ 11 Sep. 1912. Ibidem	No. S. 2628 ♀ Ibidem	No. S. 4209, Bogorodsk County, Moscow Province, Savvino village, G. I. Polyakov	No. S. 2631 ♀ Petrovsko-Razumovskoe, near Moscow	No. S. 4436 ♀ 11 Apr. 1914. Ryazan County and Province. S. S. Turov	No. S. 2070 sex. 21 Oct. 1911. Aleksandrov, Vladimir Province	No. S. 5862 ♂ Dec. 1922. Losinyi Ostrov, near Moscow	No. M. 1296 ♂ 20 Aug. 1923, Zvenigorod County, Moscow Province. O. A. Kharuzin	No. M. 1287 ♂ 1 July 1922. Moscow County. K. Flerov	No. M. 1301, 12 Apr. 1917, Kostroma Province. B. Voskresenskii	No. M. 1300 ♀ 24 July 1925. Kemetskaya Subdistrict, Valdai County, Novgorod Province	No. 14 ♀ 5 Aug. 1932. Rzhev County, Tver Province. S. U. Stroganov
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	218
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	170
Length of hind feet without claws	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	54
Length of ear	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of skull	51	50.2	50.1	51.9	52.2	52.3	51.5	52.6	51.6	50.8	52.6	53	51	49.8	52.3	—
Basal length of skull	38.3	39.7	39.9	40	40.3	40.3	40.9	41.1	41	d.	40.3	40.3	40.5	38.6	41	—
Condylobasal length of skull	44.5	46.3	46.1	46.3	47.5	46.3	47.2	48	47.6	45.3	47	47.6	46.2	44.6	47	—
Maximum width	24.2	23.2	23	23	23.1	23	21.8	22.5	22.1	22	23.2	23.6	22.2	22.4	23	—
Interorbital space	17.6	18.2	18.8	18.7	18.2	18.2	17.5	19.9	19	18.2	18.6	18.6	16.7	17.9	19	—
Zygomatic width	32	31.5	32	32.2	31	32	30	33.4	33.2	20.6	31.1	31.5	29.8	29.6	32	—
Height at level of bullae osseae	22.3	22	22.8	21.7	22.6	22.8	22	22.2	21.3	20.3	22	22.6	21.7	21.7	21.7	—
Height in region of bony palate	13.5	14	13.2	14.2	14	14.7	14.7	13.7	14.1	13.5	13.7	14	13.4	12.5	14.6	—
Length of nasals	16	15.1	15.6	17	16.3	16.3	16.2	16.8	16	15.8	16	15.2	15	15.8	17.2	—
Length of braincase	28.3	28	27	28.8	28	29.1	27.2	28.7	27.2	27	28.4	28.8	28.3	26.3	28.2	—
Width of rostrum	8.9	9.6	9.6	9	9.1	9.3	8.1	10	9.3	8.3	9.2	9.1	8.8	8.6	9.2	—
Length of bullae osseae	10.2	10.2	10.5	10.2	11	11	11.2	11	10.6	10.3	10.8	10.9	10.2	11.2	12	—
Width of bullae osseae	8.3	7.9	8.7	8.3	7.6	8	7.7	9	8.6	8	8.2	8	8.1	6.5	8	—
Upper tooth row	9.5	9.2	9	9	9.9	9.7	8.9	9.6	9.6	9.5	9.2	9.2	9	9.1	9.2	—
Lower tooth row	9.2	9.1	8.8	9	9.5	9.3	8.7	9	9	9.2	9.2	9.2	9	8.7	9.2	—
Width of skull between infraorbital foramina	10	9.7	10.3	10.1	10	10.9	10	10.6	10.2	10.2	9.9	10	10.3	9	11.2	—
Age, years	1	—	—	5	~5	1	—	4	1	—	—	—	—	—	4	—

TABLE 39

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris ognevi Migulin								Sciurus vulgaris fedjushini Ogn.				Sciurus v. formosovi Ognev.				
	No. 58 ♀ 27 Sep. 1932. Sorokino Village, Rzhev District (former Tver Province)	No. 30 ♀ 25 Aug. 1932. Pogorelovo Village. Ibidem	No. 27 ♂ 22 Aug. 1932. Sorokino Village. Ibidem	No. 13 ♂ 3 Aug. 1932. Akulovo Village. Ibidem	No. 59 ♀ 27 Sep. 1932. Sorokino Village. Ibidem	No. 55 ♂ 23 Sep. 1932. Pogorelovo Village. Ibidem	No. 44 ♂ 11 Sep. 1932. Semizharovskii District, Yel'tsy Village (former Tver Province)	Sciurus vulgaris ognevi Migulin. Average	No. M.3651 ♂ 16 Mar. 1929. Vicinity of the town Polotsk. B. Slesarevich	No. M.3657, 22 Oct. 1929. Mozyr District, Pleshchenicheskoe Forestry	No. 2404 ♀ 22 May 1911. Slutsk County, Minsk Province. A. V. Dedyushin	Sciurus vulgaris fedjushini Ogn. Average	♀ 9 July 1930. Ponazyrevo, Northern Railway, Sharya District. A. N. Formozov	♀ 28 July 1930. Ibidem	♀ ad. 14 Sep. 1930. Vicinity of Yakovlevo Village, Sharya District. A. N. Formozov	♀ 4 July 1930. Kiselevo village, near the Ponazyrevo railway station A. N. Formozov	♀ 14 July 1930. Yakovlevo village, Sharya District
Length of body and head	212	220	134	200	222	220	210	217.0	227	—	—	—	230	223	228	205	215
Length of tail without terminal hair	173	190	170	175	160	168	179	173.1	145	—	—	—	156	185	175	140	170
Length of hind feet without claws	58	58	57	57	61	58	59	57.8	57	—	—	—	57	56	61	54	60
Length of ear	—	—	—	—	—	—	—	—	33	—	—	—	26	30	35	25	31
Length of skull	—	—	—	—	—	—	—	51.2	51.6	52	53	52.2	50	52.6	52.1	49.7	50
Basal length of skull	—	—	—	—	—	—	—	40.0	41	41.9	—	41.4	d.	41.6	40	40.1	38.6
Condylobasal length of skull	—	—	—	—	—	—	—	46.4	48	48.2	49	48.4	d.	84.7	47.2	45	45.2
Maximum width	—	—	—	—	—	—	—	23.1	22.5	24	22.7	23.1	23.9	24	23.6	22.6	22.1
Interorbital space	—	—	—	—	—	—	—	18.6	18.2	17.7	19.2	18.4	17.[?]	19.8	17.9	18.3	17.5
Zygomatic width	—	—	—	—	—	—	—	31.5	31.7	32.3	32.5	32.2	31.7	32.2	32.	31.3	30.1
Height at level of bullae osseae	—	—	—	—	—	—	—	22.0	22.2	21.1	22.8	22.0	21.6	22.1	22.2	21	21.3
Height in region of bony palate	—	—	—	—	—	—	—	13.9	13.5	14.2	14.2	14.0	14	15.6	15	13.1	13.2
Length of nasals	—	—	—	—	—	—	—	15.7	15.7	d.	16	15.8	d.	16.6	16.1	16	15.2
Length of braincase	—	—	—	—	—	—	—	27.8	28.3	28.2	d.	28.2	d.	28.2	28.6	27.3	27
Width of rostrum	—	—	—	—	—	—	—	9.1	9.6	9.8	9.8	9.7	9	9.3	9.9	8.9	9
Length of bullae osseae	—	—	—	—	—	—	—	10.7	10.8	10.8	12	11.2	11.7	10.4	11.6	10.3	10.3
Width of bullae osseae	—	—	—	—	—	—	—	8.0	7.5	8	7	7.5	7.8	8.8	9	7.5	8.1
Upper tooth row	—	—	—	—	—	—	—	9.2	9.6	9.9	10	9.5	9.2	6.1	9.2	9.6	9.2
Lower tooth row	—	—	—	—	—	—	—	9.0	9.2	10	9.5	9.6	8.9	9.1	9	9	9
Width of skull between infraorbital foramina	—	—	—	—	—	—	—	10.0	10	10.9	10.7	10.5	9.5	10.5	11	9.2	10
Age, years	—	—	—	—	—	—	—	—	adult.	adult.	2	—	~2	>5	3	—	1
Weight, g.	—	—	—	—	—	—	—	—	—	—	—	—	339	370	324	282	254

TABLE 40

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris formosov Ognev									Sciurus vulgaris varius Barret-Ham ex Kerr.						
	No. 7 ♀ 11 Nov. 1930. Yakovlevo village, Sharya District. A.N. Formozov	No. 6 ♀ 10 Nov. 1930 Ibidem	No. 38, 6 Sep. 1930 Yakovlevo village, Sharya District	No. 34, 6 Sep. 1930. Ibidem	No 31. 1 Sep 1930 Ibidem	No 5 ♂ 10 Nov. 1930 Ibidem	No. 49 Ibidem	No 50. Ibidem	Sciurus vulgaris formosovi Ogn. Average	No. M.3357. Winter 1928. Umba. Kola Peninsula A. G Markonet	No. M.3355. Winter 1928. Ibidem	No. M.3358. Winter 1928. Ibidem	No. M.3354. Winter 1928. Ibidem	No. M.3353. Winter 1928. Ibidem	No. M.3356. Winter 1928. Ibidem	Sciurus vulgaris varius Barret-Ham. ex Kerr. Average
Length of body and head	215	210	—	—	—	—	—	—	218.0	—	—	—	—	—	—	
Length of tail without terminal hair	175	170	—	—	—	—	—	—	167.3	—	—	—	—	—	—	
Length of hind feet without claws	—	—	—	—	—	—	—	—	57.6	—	—	—	—	—	—	
Length of ear	—	—	—	—	—	—	—	—	29.4	—	—	—	—	—	—	
Length of skull	51.3	~51.5	51.2	51.1	50.8	51.1	52	52.3	51.2	50.9	50	49	49	53.6	51.2	50.6
Basal length of skull	d.	d.	39.8	39	39.8	d.	39.1	40	39.7	39	39.6	37.8	37.9	41.3	40	39.3
Condylobasal length of skull	46	d	46.2	46.2	46.2	46.3	46.3	46.2	46.3	45.7	45.6	44	44.2	48.6	46.3	45.7
Maximum width	21.1	23	23	22.6	22.2	22.2	23	22.6	22.8	24	23	22.2	21.2	24	22	22.7
Interorbital space	19	19.1	18.2	18.5	18.7	18.2	19	18.7	18.5	17.7	17.8	18.2	18	20.2	17.3	18.2
Zygomatic width	31	32	31	30.7	29.9	31	32	30.6	31.2	30.2	30.6	30.8	31	31.6	30.6	30.8
Height at level of bullae osseae	22.5	22.7	22.1	22.1	21.7	22.6	21.9	23.2	22.0	21.5	21	20.2	21	22.7	21.9	21.4
Height in region of bony palate	12.8	13.5	13.3	14.9	13.2	14.2	14.1	14.1	13.9	14.1	14	12.7	13.2	15	14.2	13.9
Length of nasals	16.1	d.	14.7	15.2	15.2	15.3	16	16.2	15.7	15.8	15	14.7	15.3	16.2	15.1	15.4
Length of braincase	27.9	28.1	27.3	27.2	27.2	27.6	28.2	27.5	27.7	27	27.2	26.5	27.3	28.2	27.6	27.3
Width of rostrum	8.8	d.	9	9	8.8	8.1	9.8	8.6	9.0	9.2	9	9	9	9.5	9.2	9.2
Length of bullae osseae	9.8	10.7	10.9	10.2	10.3	11.1	10.5	10.3	10.6	11	10.2	10.2	10.2	11	10.8	10.6
Width of bullae osseae	7.7	9	7.3	8.6	7.8	8	8	8	8.1	8	7.8	7	7.8	8.3	7.5	7.7
Upper tooth row	9.1	9.1	9	10	9.4	9.2	9.2	9	9.2	9.3	9.2	9	9.1	9.6	9.8	9.3
Lower tooth row	9	9	9.1	9.3	9.1	8.9	9.2	9	9.0	9.2	8.9	8.9	9	9.2	9.7	9.2
Width of skull between infraorbital foramina	10	—	10	10	10	9.3	9.8	9.5	9.9	10.2	10.2	10	10.5	10.6	10	10.2
Age	1	—	1	—	—	—	2	1	—	ad.	ad.	ad.	ad.	2	1	—
Weight	250 g	300 g	—	—	—	—	—	—	302.7 g	—	—	—	—	—	—	—

TABLE 41

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris ukrainicus Migulin			Sciurus vulgaris kessleri Migulin											
	No.S.3399 ♂ 11 Apr. 1915. Zmiev County, Kharkov Province. A.A.Migulin	No.M.1306 ♀ 22 Sep. 1920. Forest near Grafskaya, former Voronezh County. S.I.Ognev	Sciurus vulgaris ukrainicus Migul. Average	No.S.3106 ♀ 22 Mar. 1916. Cherkassy former Kiev Province. L.A.Portenko	No.S.5860 ♂ 16 Sep. 1916. Ibidem	No.S.5857, 6 Sep. 1916. Ibidem	No.S.5859 ♂ 6 Sep. 1916. Ibidem	No.S.5861 ♂ 6 Sep. 1916. Ibidem	No.S.3400, 20 Aug. 1915. Ibidem	No.S.4721 ♀ 17 Apr. 1916. Chigirin County, Kiev Province. N.Kremenetskii	No.M.1315 ♀ 25 Apr. 1919. Pushcha Voditsa, forest, vicinity of Kiev. L.A.Portenko	No.M.1307 ♂. Kiev County. L.A.Portenko	No.M.3705 ♂ 9 Dec. 1929 Vasil'evichi, Polesskii County, Gomel District	No.M.3704 ♂ 25 Nov. 1927. Pochapintsy village, Zvenigorod District, Kiev Province	No.M.3856 ♂ 14 Nov. 1927. Ibidem.
Length of body and head	250				242	240	232	232	—	—	240.5	—	240	215	240
Length of tail without terminal hair	175				187	192	193	179	—	—	193	—	180	183	205
Length of hind feet without claws	62				56	61	61	57	—	—	61.5	—	57	53	50
Length of ear	33				34	32	32,5	35	—	—	34	—	33	29	20
Length of skull	53	53,4		54,9	53,4	54	53,5	51	52,3	55,2	—	54,7	53	54,2	53,8
Basal length of skull	41,2	42		43,9	42,3	42	42,2	40,9	41	42,7	—	—	41,8	42,2	43
Condylobasal length of skull	48,2	48,6		51,6	49,3	49,2	50	48	49	49,8	—	—	48,6	49,8	49,2
Maximum width	24,2	23,2		25	24	24	24,2	23	23	24,5	—	22,7	24	24,2	23,5
Interorbital space	17,3	19		20,7	20,7	20	19	18.5	19,7	21	—	19,5	19	19,5	19
Zygomatic width	31,3	32,5		33,7	32,6	33,2	32	32	32,2	32,5	—	31	32,6	32	31,2
Height at level of bullae osseae	21	22,9		22	21,2	23,7	21,7	20,7	22	22	—	—	21,7	22,1	22,2
Height in region of bony palate	13,6	14,9		14,2	15,3	14,5	14,2	15	14,3	15	—	13,6	15,1	15	13,2
Length of nasals	16,1	15,9		17	16,1	16,7	16,7	16,1	17	16,2	—	15,6	15	17,2	16,1
Length of braincase	28,3	27,2		28,5	28,1	29	29,7	27	23	28,7	—	29	27,7	29,1	28,8
Width of rostrum	9	8,5		10,2	9	9,7	9,7	9.5	9,8	9,7	—	9,9	9,5	9,6	10,1
Length of bullae osseae	11,2	11,3		10,3	11	11,3	11,2	10,9	11,2	12	—	12,6	10,8	12,6	11,3
Width of bullae osseae	8,9	8,2		8,2	8	8	8,8	8,2	8,1	8,1	—	7,9	8	8	8,2
Upper tooth row	10,1	10,1		10	9,7	10	9,8	9,9	10,1	9,4	—	10,1	9,5	9,4	9,9
Lower tooth row	9,3	10		9,2	9,1	9,3	9,5	9.5	10	9	—	9,3	9,1	9	9,2
Width of skull between infraorbital foramina	10,8	10,2		10,3	10,7	10,2	10,2	10,8	10,4	11	—	10	11,2	11,1	11,9
Age, years	2	1		>5	~5	~4	~2	of the first year	~2	4	—	Young squirrel Subad.	of the first year	2	of the first year

TABLE 42

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris kessleri Migulin						Sciurus vulgaris bashkiricus Ognev												
	No. M.3653, 21 May 1926. Pochapintsy, Zvenigorod District, Kiev Province	No. M.3775 ♂ 7 June 1916. Motovilovka Village, Kiev Province. L. A. Portenko	No. S. 5856, 27 Apr. 1916. Cherkassy, Kiev Province. L. A. Portenko	No. S. 5858 ♀ 6 Sep. 1916. Ibidem	No. M.3652 ♂ 23 Feb. 1930. Rychevo Village, Turov District, Mozyr Region	Sciurus vulgaris kessleri Migulin. Average	No. M.3395, 2 Oct. 1929. Borovskoe forestry, Buzuluk pine forest	No. M. 3352 ♀ 25 Nov. 1929. Shkotovskoe forestry, Buzuluk pine forest	No. M. 3388, 31 Oct. 1929. Ibidem	No. M. 3351 ♂ 25 Nov. 1929. Ibidem	No. 131 ♂ 1 Feb. 1909. Samara [Kuibyshev] County. V. N. Bostanzhoglo	No. 130 ♂ 1 Feb. 1909. Ibidem	No. 11 ♂ 2 Aug. 1906. Buzuluk pine forest. Mogutovo	No. 47 ♂ 19 Oct. 1906. Ibidem	No. S. 5389 ♂ 16 Jan. 1930. Buzuluk pine forest	No. S. 5390 ♀ 16 Jan. 1930. Ibidem	No. S. 5391 ♂ 17 Jan. 1930. Ibidem	No. S. 5388 ♀ 15 Jan. 1930. Buzuluk pine forest. ZMMU collection	Sciurus vulgaris bashkiricus Ognev. Average
Length of body and head	220	250	—	240	232	235.9	—	232	280	235	260	255	265	250	223	227	225	226	243.5
Length of tail without terminal hair	190	185	—	198	182	188.9	—	164	185	175	—	—	—	—	197	205	170	203	185.6
Length of hind feet without claws	60	65	—	63	53	58.0	—	56	57	54	52	54	51.3	52	51	49	49	56	52.8
Length of ear	33	31	—	29	28	30.9	—	36	41.1	37	—	—	—	—	26	26	29	27	31.7
Length of skull	d.	53	55.2	55	52.5	53.7	53.9	52.3	53.5	d.	53	54.7	53.3	51	—	—	—	—	53.2
Basal length of skull	d.	42	42.2	42.3	d.	42.2	d.	41	41.2	d.	41.7	42.1	40.7	40.4	—	—	—	—	41.3
Condylobasal length of skull	d.	48.9	49.7	50.2	d.	49.5	d.	48.3	48.7	d.	47.8	48.5	48.3	47.3	—	—	—	—	48.2
Maximum width	d.	23.1	23.1	24.3	d.	23.8	26	25.8	25.3	d.	22.7	24.1	26	24.1	—	—	—	—	25.0
Interorbital space	18	19.9	20	21	19	19.6	19.2	19.8	19.8	19.3	20.1	21.2	19	18.1	—	—	—	—	19.5
Zygomatic width	31	32.8	33	34.1	32	32.5	34	33.8	d.	d.	33	34.2	33.2	31.2	—	—	—	—	33.2
Height at level of bullae osseae	22.1	21.7	21.6	21.2	d.	21.9	21.7	22.2	23.3	d.	21.9	22	23.4	22.1	—	—	—	—	22.3
Height in region of bony palate	13.1	14.8	14.2	14.7	14.1	14.4	15.1	15	15.6	14.2	13.8	15.7	14.8	13.3	—	—	—	—	14.8
Length of nasals	d.	16.2	17.5	17.2	16.1	16.4	16	16	14.2	16	17.3	17.9	17.3	15.3	—	—	—	—	16.2
Length of braincase	28	28	28.7	29	d.	28.2	d.	28.6	29.4	d.	28.1	29.3	29.7	29	—	—	—	—	28.9
Width of rostrum	9.8	9.7	9.6	9.2	9.1	9.6	9.8	9	9.9	9.3	9.8	9.8	10	11	—	—	—	—	9.8
Length of bullae osseae	d.	11.1	11.2	11.8	11.2	11.4	11.2	12	11	d.	10.8	11.8	11.7	11	—	—	—	—	11.3
Width of bullae osseae	d.	8	8.2	8.1	8.2	8.1	8.8	8.2	9	d.	9.9	10.3	11.6	10	—	—	—	—	9.6
Upper tooth row	10	10.2	10.1	10	10	9.8	d.	10	10.2	9.2	9.2	9.8	9.8	9.2	—	—	—	—	9.7
Lower tooth row	9.5	9.1	9.7	9.4	9.2	9.3	—	9.2	9.6	9	9.1	9.2	9.1	9	—	—	—	—	9.2
Width of skull between infraorbital foramina	11.1	10	10.2	10.2	10.2	10.6	11	11.4	11.5	10.1	—	—	—	—	—	—	—	—	10.0
Age in years	1	> 5	5	4	1	—	>6	2	1½	5	—	—	—	—	—	—	—	—	

TABLE 43

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris bashkiricus natio uralensis Ognev								Sciurus vulgaris martensi Matschie						
	No. M.2154 (178) 15 Sep. 1926. Miass, former Troitsk County, former Orenburg Province. S.I. Snigirevskii	No. M.1649 (174) ♀ 26 Sep. 1926. Ibidem	No. M.1646 ♂ 13 Sep. 1926. Ibidem	No. M.3773 ♂ 13 Sep. 1926. Ibidem	No. M.1648, 12 Oct. 1926. Ibidem	No. M.1645 ♀ 26 Sep. 1926. Ibidem	No. M.3656 ♂ ad. 21 July 1928. Sources of Neys' river, eastern slopes of Northern Urals. L.A. Portenko	Sciurus vulgaris bashkiricus natio uralensis Ognev. Average	No. 40 ♀ 23 Sep. 1932. Vynchina, valley of the Ob. Surgut District	No. 33 ♀ 22 Sep. 1932. Ibidem	No. 51 ♀ 25 Sep. 1932. Ibidem	No. 29 ♀ 21 Sep. 1932. Ibidem	No. 26 ♀ 21 Sep. 1932. Ibidem	No. 54 ♀ 25 Sep. 1932. Ibidem	No. 24 ♀ 20 Sep. 1932. Ibidem
Length of body and head	—	—	—	—	—	—	215	—	221	214	228	217	224	238	218
Length of tail without terminal hair	—	—	—	—	—	—	165	—	170	145 ?	173	168	152 ?	178	139 ?
Length of hind feet without claws	—	—	—	—	—	—	54	—	58.1	59.9	59.2	58.1	58.2	60.9	55.5
Length of ear	—	—	—	—	—	—	31	—	24.6	26.1	25.1	24.3	22.1	27.9	24.3
Length of skull	53.6	51.4	51.2	52.9	52.9	51.1	50.6	51.7	52.6	51.9	55.8	52.6	53.2	—	—
Basal length of skull	42	39.8	d.	41.3	40.6	40.1	38.6	40.1	41.5	41.1	45.2	40	42	—	—
Condylobasal length of skull	48.6	45.5	d.	48.2	46.5	46.5	45.3	46.6	48	47.2	51.2	46.5	48	—	—
Maximum width	26	22.9	d.	24.1	22.3	22	23.6	23.0	23.7	22.3	24.5	22.3	23	—	—
Interorbital space	19	17.7	19	18.3	17.4	17.3	17.4	17.8	18.9	16.3	18.2	19.1	19.6	—	—
Zygomatic width	33.2	31.5	33	33	31.7	29.8	29.7	31.5	32.8	29.8	31.3	30.2	30.3	—	—
Height at level of bullae osseae	22	21.8	22.2	21.6	21.3	22.3	22.7	22.0	22.2	22	22.7	22.6	22.2	—	—
Height in region of bony palate	15.9	14.2	14.1	13.9	14.9	14.8	13.2	14.2	14	13.5	15	14	14.8	—	—
Length of nasals	15.7	15.2	15.2	16.9	16	15	14.6	15.5	15	14.2	17	16.2	16	—	—
Length of braincase	28.2	27.5	27.2	28.2	27.3	28	27.6	27.6	28	27.8	28.3	28.2	27.5	—	—
Width of rostrum	9.8	9.2	9.6	9	9.2	9.8	8.3	9.2	9	9	9	8.8	8.7	—	—
Length of bullae osseae	11	11.1	11.3	12	10.2	10.3	10.9	11.0	11	10.6	11	10.5	10.7	—	—
Width of bullae osseae	9	8	7.6	9.1	7.7	7.6	7	7.8	7.6	7	7.5	7.6	7.7	—	—
Upper tooth row	10.2	9.2	9.2	9.8	8.9	d.	9.2	9.3	9.2	9.6	9.1	9.1	9	—	—
Lower tooth row	10	9.1	9.1	d.	8.4	9.3	9	9.0	8.5	d.	9.1	9.0	9	—	—
Width of skull between infraorbital foramina	10.2	10.1	10.2	9.5	9.6	10	10	9.9	11.8	—	9.8	9.3	d.	—	—
Age, years	~4	1	2	4	3	1	1	—	1	—	2	2	1	—	—

TABLE 44

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris martensi Matschie														
	No. 15 ♀ 17 Sep. 1932. Vamakina, Surgut District	No. 8 ♀ 9 Sep. 1932. Tundrino, Surgut District	No. 6 ♂ 8 Sep. 1932. Ibidem	No. 74 ♀ 24 July 1932. Vynchina, Surgut District	No. 2 ♂ 24 Aug. 1932. Egan river, Surgut District	No. 134 ♂ 15 Aug. 1932. Kol-Egan river, Surgut District	No. 53 ♂ 18 July 1932. Vynchina, near Ob river	No. 1 ♂ 6 Sep. 1932. Tundrino area, Surgut District	No. 85 ♂ 27 July 1932. Kargasheva, Surgut District	No. 6 ♀ 25 Aug. 1932. Aleshkino, Ob, Surgut District	No. 50 ♂ 25 Sep. 1932. Vyrchina, a tributary of the Ob	No. 25 ♀ 20 Sep. 1932. Ibidem	No. 31 ♀ 22 Sep. 1932. Ibidem	No. 45 ♂ 24 Sep. 1932. Ibidem	No. 21 ♂ 20 Sep. 1932. Ibidem
Length of body and head	223	233.5	218	230	225	241	215	221	230	220	216	195	204	224	213
Length of tail without terminal hair	162	176	166	165	178	167	160	157	180	178	162	157	170	163	166
Length of hind feet without claws	57.2	60.1	60.4	55.5	57	59.8	56.5	52.1	59	56	53.1	56.1	56.5	58.3	59.2
Length of ear	23.5	22.2	26.3	29	38	30.5	29.7	34.2	32.5	32	23.9	24.2	26	23.9	27
Length of skull	—	—	53.8	—	53.5	—	52	—	53.9	51.3	51.1	51	51.6	51.3	54.5
Basal length of skull	—	—	42.1	—	41	—	39.2	—	41.1	41.2	40.2	40	40	40	39.8
Condylobasal length of skull	—	—	48.2	—	47.2	—	46.1	—	48.2	d.	46.7	46	47.2	45.6	46.3
Maximum width	—	—	23.1	—	23.2	—	d.	—	23	d.	22	22.5	22.5	23.2	24
Interorbital space	—	—	18.7	—	19.1	—	18.9	—	19.1	19	17.1	17.9	18.2	18.2	16.8
Zygomatic width	—	—	30.7	—	30.1	—	30.2	—	30.7	30.7	30	30	30	29.8	30
Height at level of bullae osseae	—	—	21.3	—	22.8	—	22.1	—	22.7	22	21.3	22.8	22.5	22.8	21.2
Height in region of bony palate	—	—	14	—	14.2	—	14.1	—	14.2	14	14.2	13.9	14.5	13.2	14.2
Length of nasals	—	—	16	—	16.2	—	16	—	15.8	15.2	15.6	16	15	14	16
Length of braincase	—	—	29.1	—	27.3	—	26.6	—	28.1	27.2	27.3	27.7	27.1	28	27.2
Width of rostrum	—	—	8.3	—	9.1	—	8.2	—	9.1	9.1	9	8	8	8	8.1
Length of bullae osseae	-	—	10.5	—	10.5	—	10.3	—	10.2	10.4	10.3	11.2	10	10.5	10.1
Width of bullae osseae	—	—	8	—	8.2	—	8.2	—	7.6	8	8.5	8.5	8.1	8	9
Upper tooth row	—	—	9.2	—	9.3	—	9	—	9.9	9	9.1	9.1	9.7	9.2	9.2
Lower tooth row	—	—	9	—	9	—	9	—	9.1	—	9.3	9	9	9	9
Width of skull between infraorbital foramina	—	—	10.1	—	9.8	—	10.3	—	10.9	10	10	10	10	9.7	10.2
Age, years	—	—	1	—	~3	—	1	—	2	~2	1	1	1	1	1

TABLE 45

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris martensi Matschie						Sciurus vulgaris exalbidus Pallas.									
	No. 12 ♂ 12 Sep. 1932. Tundrino, Surgut District	No. 67 ♂ 6 Oct. 1932. Ibidem	No. 34 ♂ 22 Sep. 1932. Yurty Vynchina	No. 61 ♀ 28 Sep. 1932. Tundrino	No. 66 ♀ 6 Oct. 1932. Ibidem	Sciurus vulgaris martensi Matschie. Average	No. 500 ♀ 26 Oct. 1931. Korostelovskoe Forestry (Srostinsk forest), Semipalatinsk Region. G. Gol'tsmaier	No. 528 ♀ 6 Nov. 1931. Ibidem	No. 107 ♀ 14 Dec. 1930. Ibidem	No. 8 ♀ 27 Aug. 1930. Ibidem	No. 333 ♀ 25 May 1931. Ibidem	No. 79 ♀ 1 Dec. 1930. Ibidem	No. 618 ♀ 25 Nov. 1931. Ibidem	No. 553 ♀ 4 Nov. 1931. Ibidem	No. 629 ♂ 3-4 Dec. 1931. Ibidem	No. 440 ♂ 13 Nov. 1931. Ibidem
Length of body and head	224	213	210	209	219	220,1	243,1	247,7	229,8	240	—	233,6	245,4	232,2	244,3	224,6
Length of tail without terminal hair	162	169	168	163	192	166,1	204,1	184,2	202,5	202,7	—	208,6	198,5	193,6	153,2	200
Length of hind feet without claws	58,1	58,5	59,7	58,9	61,1	57,4	66,5	62,3	62,8	64,5	—	64,3	64,1	63,8	61,7	56,6
Length of ear	25,9	25,6	24,6	24,9	25,4	26,8	37,7	32,3	37,1	34,4	—	32,2	33,3	30,9	31,6	36,2
Length of skull	52,3	52	54	52,5	53,2	52,4	58,2	56,6	56,2	57,9	59,2	58,2	58,2	55,5	56,1	57,3
Basal length of skull	40	40,2	39,4	40,7	41,3	40,8	43,6	44,2	43,2	44,2	45	45,3	44	43,7	43,5	44,5
Condylobasal length of skull	46,3	46,8	46,8	47,2	47,9	47,2	52,1	52,1	51	53,2	53,2	52,3	53,2	51	50	52,3
Maximum width	23,6	23	23,1	24	24,5	23,2	28	26,9	27,1	27	27,6	26	27	27	26	27
Interorbital space	18	19	17,8	19	19,8	18,4	20,6	21,3	22	21,1	20,1	21,3	20,3	20,2	21,1	20,2
Zygomatic width	31	30,1	29,8	31,2	30,2	30,4	35,6	35,1	36	35,3	36,2	35	34,6	35,2	33,1	35
Height at level of bullae osseae	22,7	21,2	22	22,1	21,3	22,1	23,7	22,6	24	23,2	22,2	22,1	21,2	22	22,3	22
Height in region of bony palate	14,3	13,7	13,3	13,6	14,2	14,0	16	16,1	16,2	16,6	16,8	16,1	15,7	15,	15,1	16,1
Length of nasals	16,1	15,2	15,6	16	15	15,6	19,2	18	18,1	18,2	19,3	19	19	17,2	17,3	18,6
Length of braincase	27,6	28,5	26,3	27,3	28,7	27,7	30,6	31	30,2	31,1	32,2	30,5	31,2	30	30,2	30,3
Width of rostrum	8,2	8,2	8	8,1	8,1	8,5	10	10,6	10,2	10	10,1	9,7	9,3	9,6	10,2	—
Length of bullae osseae	10,2	10,2	10	10,9	10,6	10,5	11	11,3	12	11,3	12	12,3	12,1	11,1	11,1	11
Width of bullae osseae	8,1	8,2	8,6	7,9	8,2	8,0	9,9	8,8	9	9,9	10	9,5	9,3	9,1	9	8,6
Upper tooth row	9,3	9,1	9,3	9,2	9,6	9,3	10,5	10,2	10,2	10,9	10,7	10,2	10,3	10,5	10	10,2
Lower tooth row	9,2	8,8	8,8	8,9	9	8,1	10,2	10,3	11	10,6	10,1	10,1	10,6	10,2	9,3	10,2
Width of skull between infraorbital foramina	10	10,2	9,0	9,2	10	9,0	11	10,2	11	11,2	11,3	10,3	11	10,3	11,1	11
Age, years	1	1	1	1	1	—	2	2½	2½	2½	2	3	1	1	3½-4	4½
Weight	—	—	—	—	—	—	456 g	487 g	457 g	486 g	—	463 g	390 g	363 g	405 g	379 g

TABLE 46

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris exalbidus Pall.													
	No. 426 ♂ 3 Sep. 1931. Korostelevskoe Forestry (Srostki forest), Semipalatinsk Region. G. Gol'tsmaier	No. 275 ♀ 28 Apr. 1931. Ibidem	No. 536 ♀ 7 Nov. 1931. Ibidem	No. 438 ♂ 9 Sep. 1931. Ibidem	No. 106 ♂ 14 Dec. 1930. Ibidem	No. 516 ♂ 5 Nov. 1931. Ibidem	No. 28 ♂ 6 Nov. 1931. Ibidem	No. 522 ♀ 1-4 Nov. 1931. Ibidem	No. 11 ♂ 2 Sep. 1930. Ibidem	No. 166 ♂ 1-2 Jan. 1931. Ibidem	No. 298 ♂ 11 May 1931. Ibidem	No. 546 ♂ 1-7 Nov. 1931. Ibidem	♀ Sem. 19 Sep. 1933. Near village Zerendy, [illegible]0 km southwest of Kokchetav. N. A. Bobrinskii	Sciurus vulgaris exalbidus Pall. Average
Length of body and head	249.3	214.3	251.6	232.7	233.6	233.7	236.8	246.5	293.4	232.2	239.9	247.7	260	241.5
Length of tail without terminal hair	187.3	191.3	202.5	197.6	200	193	186.6	191.4	208.6	222.2	189.7	188	210	196.2
Length of hind feet without claws	64.7	58.1	56.1	64.5	61.8	63	64.4	64.5	63.1	64.3	63.4	66.1	—	62.9
Length of ear	33.7	33.7	33.8	37.2	34.7	34.7	38.8	33.5	33.3	34.5	33.8	35.5	—	34.4
Length of skull	56	56	57.6	56	56.1	54.6	57	57.2	57	57.1	57.2	56	56.7	56.9
Basal length of skull	44.3	42.8	44.3	43.3	43.7	42.2	43.3	45	44.2	44.1	44.2	44.3	44.2	44.0
Condylobasal length of skull	52	51	52.6	51.3	52	50.5	52.1	52.2	52.2	52	52.8	52	51.8	52.0
Maximum width	25	26.3	28.3	25.3	26.2	26	26	26.3	26.8	26.3	26.2	27.1	26.5	26.6
Interorbital space	20.2	21.1	22	25.1	21.2	20	20.1	21	20.8	21	20.7	19.6	21	21.0
Zygomatic width	35	35.2	35.6	34.3	35	33.3	34	35	35.2	34.5	34	35	35.2	34.9
Height at level of bullae osseae	22.1	21.3	22.3	22.3	22.6	22.8	23	22.2	23.5	22.3	22.3	22.9	23.2	22.5
Height in region of bony palate	15.2	15.2	16.6	16.1	15.2	15	15.3	16.3	16.2	16	16.3	15.1	16.2	15.8
Length of nasals	17.2	17.1	18	18.1	18.2	17	18	18.9	17.5	18	17.5	17.3	19	18.0
Length of braincase	30.2	30.6	32.1	30	30.3	29	30.2	39.7	31.2	30	31	31.1	30.2	30.6
Width of rostrum	9.3	10.1	10.1	9.2	10	9.8	9.2	10	11.1	9.5	9.5	9.2	10	9.8
Length of bullae osseae	11	11	11.8	11.6	12.4	10.9	12.5	11	12.3	12.1	13.1	11.6	11.2	11.6
Width of bullae osseae	9.1	9	8.3	9.2	8.9	8.6	9.2	9	8.2	10	9	10.1	10	9.2
Upper tooth row	10.2	10.1	10.8	10.3	11.1	11.1	11	10.2	10.5	10	10	10.3	10.2	10.4
Lower tooth row	10.1	—	—	10.1	10.1	10.3	10.9	10.1	10	11.2	9.2	11	10	10.3
Width of skull between infraorbital foramina	10.2	10.3	11.1	10.3	10.9	11	11	11	11.2	11.2	10.9	11	10.1	10.8
Age, years	4	4½	~5	~3	2½	2	1	3	~2	—	2	~3	~4	—
Weight	442 g	—	484 g	410 g	416 g	425 g	452 g	446 g	445 g	403 g	443 g	466 g	—	—

TABLE 47

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris jenissejensis Ognev															
	No. S. 6220 ♂ Autumn 1929. Vivi Trading post, estuary of Vivi river joining Lower Tunguska river. N. P. Naumov	No. S. 6197 ♂ Ibidem	No. S. 6187 ♂ Ibidem	No. S. 6202 ♂ Ibidem	No. 6183 ♂ Ibidem	No. S. 6224 ♂ Ibidem	No. S. 6214 ♂ Ibidem	No. S. 6200 ♂ Ibidem	No. S. 6208. Ibidem	No. S. 6285, Nov. 1929. Between estuaries of Dyalingda and Dyagegli rivers, on Lower Tunguska river.	No. S. 6276. Ibidem	No. S. 6270. Ibidem	No. S. 6271. Ibidem	No. S. 6293. Ibidem	No. S. 6272. Ibidem	No. 75 ♂ 23 Oct. 1926. Lower Tunguska river, Turukhansk Territory. N. P. Naumov
Length of body and head	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	206
Length of tail without terminal hair	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	160
Length of hind feet without claws	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	57
Length of ear	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	32
Length of skull	53,7	53	52,7	53	53,1	53	51,3	52,9	51,8	52	52,3	52	53	53,2	52	51,2
Basal length of skull	41,3	41	40,3	40,3	40,5	40	40	40,1	40	40,3	40,3	40,6	41	42	41,3	40
Condylobasal length of skull	48,6	48,2	47,3	47,3	48,1	48	47,6	48,2	47,3	48,1	48,2	47,2	47,3	49,1	49,2	47,2
Maximum width	25,2	24	23,7	22,7	23	23,1	22,9	23,6	23	24	23	23,2	23	23,1	22,5	24,9
Interorbital space	18,3	18,5	17,2	17,6	18,2	19,2	19,1	18	17,2	18,5	18,3	17,7	19	18,8	19,2	19,1
Zygomatic width	31,1	21,1	30,3	31	31	32,2	31	31,8	30	31,6	29,7	31,1	30,3	31,1	30,7	30,9
Height at level of bullae osseae	22,2	22,7	22,6	22,1	22,1	23	21,7	22,1	22,1	21,5	21,5	22,2	22,3	22,1	22,9	21,5
Height in region of bony palate	14,2	13	14,2	13	14,	13,3	12,7	14,1	13,2	13,2	14,1	13,8	14,2	13,2	13,2	14,7
Length of nasals	16,7	17	16,1	16,6	15,2	16	16	16,1	15,3	15,9	16,2	16,2	16	16,2	16	16,2
Length of braincase	28,1	28	27,3	27,1	28,7	27,7	28	27,6	27,9	28	27,2	28,7	27,7	28,1	27,2	27,5
Width of rostrum	9,1	9	8,3	8,7	9,1	9	9	9,1	8,5	9,7	9,2	9	9,1	8,8	8,9	9
Length of bullae osseae	11,1	11,2	11	10,3	10,9	11,1	11,1	11,2	10,7	10,2	10,1	11	10	11	11,2	11,7
Width of bullae osseae	8,3	8,6	7,3	8,3	7,2	7,2	7,3	8,1	7,2	8,6	8	8,6	7,9	8,1	7,2	9,2
Upper tooth row	10	9,7	9,6	9,6	10	9,5	9,2	9,9	9	9,1	9,6	9,1	9,3	9,1	9,2	9,9
Lower tooth row	9,1	9,1	9	9,1	9	8,7	8,9	9,2	9	9,2	8,7	8,7	9	9,1	9,1	—
Width of skull between infraorbital foramina	10,5	10,8	10,7	10,3	11,2	10,2	10,5	10,3	9,3	10,7	9,2	10,3	10,1	10	10	10,1
Age, years	1½	2	1½	2½	1	3	2½	1	—	2½	~4	2½	4	3½	2½	>4

TABLE 48

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris jenissejensis Ogn.								Sciurus vulgaris altaicus Serebrennikov							
	No. 173 ♀ 13 Sep. 1930. Tura river, Turukhansk Territory. N. P. Naumov	No. 174 ♂ 15 Sep. 1930. Ibidem	No. 169 ♂ 18 Sep. 1930. Ibidem	No. 74 ♂ 23 Oct. 1926. Vivi Trading post, Lower Tunguska river	No. 175 ♀ 5 Sep. 1930. Tura river, Turukhansk Territory	No. 171 ♂ 12 Sep. 1930. Ibidem	No. 176 ♀ 1930. Lower Tunguska	Sciurus vulgaris jenissejensis Ogn. Average	No. 141 ♂ Altai, Teletskoe Lake. A. M. Kolosov	No. 134 ♀ 8 Oct. 1932. R. Koldor, Lake Teletskoe	No. 128 ♀ 5 Oct. 1932. Ibidem	No. 149 ♀ 25 Oct. 1932. Ibidem	No. 129, 7 Oct. 1932. Ibidem	No. 131 ♂ 7 Oct. 1932. Ibidem	No. 140 ♀ 2 Oct. 1932. Ibidem	No. 142, 1932. Ibidem
Length of body and head	209	215	209.3	210	210	207	—	209.5	210	240	240	210	210	200	215	—
Length of tail without terminal hair	179	191	169	168	170	176	165	172.2	150	170	150	160	140	150	155	—
Length of hind feet without claws	61	62.5	56.5	61.5	58	58	56	58.8	55	60 ?	50	55	50	50	50	—
Length of ears	33	32.8	29.9	31	32	31	32	31.7	26	30	25	25	25	25	25	—
Length of skull	50.9	51.1	51.2	51	49	49.9	50.1	51.9	53.1	d.	d.	50.9	50	51.1	50	51.1
Basal length of skull	39.1	—	39	39.7	38	39.3	40	40.2	41.4	42.1	39	40	38	39	38.2	39
Condylobasal length of skull	45.5	46.2	45.1	46.5	45	45.1	46.2	47.2	47.8	48.5	46	47	46	46	45.1	46.7
Maximum width	23.2	24.7	22.1	23.8	22.3	22.5	28	23.5	24.1	d.	24.1	24	24	23	22.4	24.2
Interorbital space	17.6	18.7	18.3	18	18.2	17.3	17.5	18.2	19.3	d.	17	18	18	17.7	17.1	17.5
Zygomatic width	29.1	31.6	29	29	29	29.2	31.2	30.6	30.1	31	29.6	30.3	29.1	30.1	28.3	30.2
Height at level of bullae osseae	22.6	23.7	22.6	22	22.1	21.3	22.3	22.2	21.3	d.	22.2	22.3	21.1	22.9	21.9	22.1
Height in region of bony palate	14.6	14.5	12.7	12.7	13	14.2	12.9	13.6	13	14.5	14.9	13.9	13.6	13.2	12.5	13.2
Length of nasals	14.6	15.2	15.7	16.1	14.7	14.3	16	15.8	15.3	16	d.	15.3	15	15.3	14	15.6
Length of braincase	27.3	28	27.9	27	27.3	26.3	27.1	27.6	27.2	d.	27.3	27	27	27.2	26.3	27.7
Width of rostrum	8.6	9.5	8	8.2	8	8.2	9	8.8	8.3	9	8.3	8.7	8	8.6	8	8.1
Length of bullae osseae	10.6	10.9	10.3	11	9.8	11	10.9	10.8	11	11.9	10.2	10.2	10.2	9.5	10.8	10.1
Width of bullae osseae	8.3	8.8	7.9	8.3	8	8.3	8.7	8.1	7.1	8	7.3	7.2	8	8.9	8.3	8.3
Upper tooth row	10	10	9.3	10	10	9.2	9.3	9.5	9.9	9.1	8.8	8.8	9	9.6	9	8.9
Lower tooth row	9.2	9.2	9	—	9.1	9.2	—	9.0	8.9	9	9	8.7	8.8	9	8.7	9
Width of skull between infraorbital foramina	d.	10.8	10.2	10.3	10.2	10.3	10	10.1	9.9	11	10	9.3	10.1	10.2	9.1	10
Age, years	juven.	juven.	1	—	juven.	1	2	—	3½	4	—	~2	1	—	—	~2

TABLE 49

Measurements of Sciurus vulgaris Linn.

Subspecies	Sciurus vulgaris altaicus Serebrennikov													Sciurus vulgaris jacutensis Ogn.					
	No. 133 ♂ Lake Teletskoe, Altai. A. M. Kolosov	No. 136 ♂ 1932. Ibidem	No. 130 ♀ 1932. Ibidem	No. S. 2292. Summer 1910. Northwestern Mongolia, Lake Hŏbsŏgŏl. V. Ch. Dorogostaiskii	No. S. 4762, 15 Nov. 1924. Chamanbai Altai, ZMMU collection	No. S. 4763, 15 Nov. 1924. Ibidem	No. S. 4761 ♂ 7 Sep. 1924. Katon Karagai, 5000, south Altai	No. M. 1714 ♀ 27 Dec. 1926. Near Mondy, 25 km from Lake Hŏbsŏgŏl	♀ 20 Nov. 1926. Ibidem A. N. Formozov's collection	No. 128 ♀ Altai Reserve. A. M. Kolosov	No. 134 ♀ Ibidem	No. 150 ♂ Ibidem	Sciurus vulgaris altaicus Serebr. Average	No. M. 2209 sex 9 Oct. 1927. Magan Village, 8 km from Yakutsk. K. E. Vorob'eva	No. S. 5528, 1 Nov. 1928. Upper reaches of Kenskaya River, 120 km northwest of Khatym. I. Pavlov-Sil'vanskii	No. S. 5526, 30 Oct. 1928. Ibidem	No. S. 5525, 1 Nov. 1928. Ibidem	No. S. 5527, 2 Nov. 1928. Ibidem	Sciurus vulgaris jacutensis Ognev. Average
Length of body and head	220	225	230	—	—	—	—	240	235	240	240	240	226.3	—	—	—	—	—	—
Length of tail without terminal hair	160	166	160	—	—	—	—	150	160	150	170	170	157.4	—	—	—	—	—	—
Length of hind feet without claws	50	53	55	—	—	—	—	50	50	50	60	65	53.5	—	—	—	—	—	—
Length of ear	26	26	30	—	—	—	—	25	20	25	30	30	26.2	—	—	—	—	—	—
Length of skull	50.7	49.1	51.2	54.3	50	50	51	50.9	53.4	—	—	—	50.9	52	50.1	51.6	52.2	52	51.6
Basal length of skull	39.7	38.6	40.2	41.2	39	39.2	39.2	38.1	d.	—	—	—	39.6	40	38.9	40.2	42.3	d.	40.4
Condylobasal length of skull	46.6	47	46.2	48.5	45.3	45	45.9	45.7	d.	—	—	—	46.4	46.6	45.7	47.2	49.3	d.	47.2
Maximum width	24.1	24	24.1	d.	21.9	22	21.7	23	24	—	—	—	23.4	22.7	2[?].3	22.7	23.8	24.7	23.2
Interorbital space	18.6	18.6	17.2	19.2	16.2	18	18.8	17.6	20.3	—	—	—	18.1	19.2	17.7	17.2	18	20	18.4
Zygomatic width	29.8	29.3	30	29	28.2	29	30.2	30.9	31.8	—	—	—	29.8	32.2	30.2	29.2	32.2	31.5	31.1
Height at level of bullae osseae	22.7	21.3	22.1	20.7	21.2	22	21.7	21	22.1	—	—	—	21.8	22.2	22.3	22.1	22.1	22.3	22.2
Height in region of bony palate	13.2	13.2	13.3	13.2	13	13.1	14.1	12.2	14.1	—	—	—	13.4	14.1	13.2	14.2	12.9	13.6	13.6
Length of nasals	15	15	15.1	15.3	15.3	16	16.1	15.8	17.7	—	—	—	15.5	16.5	14.7	16	15.3	15	15.5
Length of braincase	27.9	27.3	27.5	26.2	27.2	27	27.7	27.1	d.	—	—	—	27.2	28.2	26.6	27.3	28	d.	27.5
Width of rostrum	8.2	8	8.1	9	8.2	9	9.1	9.1	8.8	—	—	—	8.5	9.9	8.3	8.5	9.2	9.7	9.1
Length of bullae osseae	11	10	11	10.3	11.2	10.2	12	10.2	12.2	—	—	—	10.7	11.2	11.3	11.7	11.2	11.2	11.3
Width of bullae osseae	8.1	8.3	9	9	9.1	9	8.4	7.9	9.9	—	—	—	8.3	9	8.2	8.2	8.9	8.7	8.6
Upper tooth row	8.9	9	9.1	9.2	9.2	9	9.1	9	9.2	—	—	—	9.1	9.1	9.8	9.8	10.2	10	9.8
Lower tooth row	8.6	8.3	9.1	8.1	8.7	8.7	9.1	9.2	9.2	—	—	—	8.8	8.9	9.2	9.3	9.3	9.7	9.3
Width of skull between infraorbital foramina	10.2	10	10.3	10.2	10	10.5	10.8	d.	10.1	—	—	—	10.1	10.3	10.2	10.8	10.9	10.7	10.6
Age in years	1	—	—	> 5	1	2½	1	~ 6	—	—	—	—	—	~ 2	1½	1	3½	~ 3	—

TABLE 50

Measurements of body and skull of Sciurus vulgaris anadyrensis Ogn.

	No. 60-1934 (151) ♂ Mar. 1932. Yeropol village, Anadyr Territory L. A. Portenko	♂ 6 Mar. 1932. Markovo village Anadyr Territory, L. A. Portenko	No. 60-1934 (793) ♂ 2 Feb. 1932. Ibidem	No. 60-1924 (795) ♂ 13 Oct. 1931. Ibidem	No. 60-1934 (792) ♂ 10 Nov. 1931.	No. 60-1934 (791) ♂ 11 Oct. 1931. Markovo village.	No. 60-1934 (794) ♀ 2 Feb. 1932. Ibidem	♀ 23 Dec. 1931. Ibidem	No. 60-1934 (790) ♀ 5 Feb. 1932	No. 60-1934 (150) ♀ 27 Feb. 1932. Ibidem	No. 60-1934 (148) ♀ 15 May 1932. Yeropol village, Anadyr Territory	Sciurus vulgaris anadyrensis Ogn. Average
Length of body and head	240	205	223	22	225	225	240	223	210	200	245	223.7
Length of tail without terminal hair	160	155	145	15	155	165	180	175	170	155	175	162.8
Length of hind feet without claws	60	—	58	60	55	55	56	62	55	50	60	57.1
Length of ear	32	32	32	32	32	31	30	27	28	30	35	31.0
Length of skull	50.3	54	53	52.6	d.	d.	53	52	50.5	53.2	52.6	52.4
Basal length of skull	38.2	41.2	43	41.3	d.	d.	41.2	40.2	39.2	42	41.2	40.8
Condylobasal length of skull	45.6	48.5	47.3	47	d.	d.	47.2	47.3	46.1	48.2	47.2	47.2
Maximum width	24	22.3	24	23.2	d.	d.	24.7	24	22.9	24.2	23.2	23.6
Interorbital space	18.9	18.3	19	18.3	d.	19.8	20.2	18.7	18.1	19	18.3	18.9
Zygomatic width	31	31.2	31.6	31.7	30.2	31.8	31.7	30.2	30	31.2	31.2	31.1
Height at level of bullae osseae	23.2	22.6	22.6	22	d.	d.	22.2	24	22.8	21.3	21.7	22.5
Height in region of bony palate	13	13	14	14.3	14.1	14	14.1	14	14.1	14	14.1	13.9
Length of nasals	16.1	17.2	17.2	16.1	15.2	16.1	16.5	15.3	15.3	16.8	16.3	16.2
Length of braincase	27	27	27	27.3	d.	d.	27.4	27.3	27.2	27.0	28.1	27.4
Width of rostrum	8.7	9	8.7	d.	8.2	9.6	9.1	9.1	8.3	9.1	9	8.9
Length of bullae osseae	11.8	11.5	10.3	11.1	d.	d.	11.3	11.3	11.4	11.3	10.3	11.1
Width of bullae osseae	9.8	8.8	8.3	7.7	d.	d.	9	8.3	7.8	7.7	8.2	8.4
Upper tooth row	9.2	10.1	8.8	9.1	9	9.3	9	9	9	9.6	9.3	9.2
Lower tooth row	9.1	9.3	9	9	9.1	9.2	8.8	9.1	9	9.7	9.2	9.1
Width of skull between infraorbital foramina	9.8	9.9	9.2	d.	10.4	10.2	10.4	10.2	9.9	11.2	10	10.1
Age, years	~4	3	1	very old ~5-6	1	1	very abraded teeth ~9	1	1	1	1½	—

TABLE 51

Measurements of Sciurus vulgaris L.

Subspecies	Sciurus vulgaris fusco-nigricans Dwigubski						Sciurus vulgaris mantchuricus Thos.									
	No. M.1324 ♂ 7 Oct. 1924. Sosnovka, Barguzin Reserve. Z. Svatosh	No. M.1321 ♀ 7 Oct. 1924. Ibidem	No. M.1323 ♂ 1 Oct. 1925. Ibidem	No. M.1318 ♀ 2 Sep. 1917. Aurachenka river, Sosnovka inlet	No. M.1322 ♀ 15 Oct. 1925. Ibidem	Sciurus vulgaris fusco-nigricans Dwigubski. Average	No. M.1341 ♂ 10 Oct. 1911. Iman County, Maritime Territory. A.I. Cherskii	No. M.1333 ♂ 1 Oct. 1911. Ussuri Territory. A.I. Cherskii	No. M.1336 ♂ 8 June 1910. Iman County. N. Ikonnikov	No. M.1339 ♂ 15 July 1910. Ibidem	No. M.1334 ♂ 25 Apr. 1910. Ibidem	No. M.1338 ♂ 28 Apr. 1910. Ibidem	No. M.1332 ♀ 29 Sep. 1911. Upper reaches of Odarka river, basin of Khanka river. A.I. Cherskii	No. M.1988 ♀ 18 June 1927. Steklyanukha village, Olga County, Maritime Territory. N.M. Dukel'skaya	No. S.1377, 31 July 1908. Vyazemskaya village, Maritime Territory. F.K. Lorents	♂ 29 Oct. 1932. Bidzhan. Yu. Salmin
Length of body and head	246	240	220	230	—	234.0	—	—	—	—	—	—	—	—	—	—
Length of tail without terminal hair	185	175	160	180	—	175.0	—	—	—	—	—	—	—	—	—	—
Length of hind feet without claws	51	51	54	60	—	54.0	—	—	—	—	—	—	—	—	—	—
Length of ear	31	32	34	32	—	32.2	—	—	—	—	—	—	—	—	—	—
Length of skull	54.2	54.3	55.5	55.8	52.7	54.5	53	51.7	54.2	53.5	56.7	54.5	54.2	56.1	~57	55
Basal length of skull	43.2	43.2	44.1	42.9	41	42.9	41.6	39.6	43	d.	44.7	42.5	42	44.7	d.	42.5
Condylobasal length of skull	51	51	52.1	49.9	48.2	50.4	49.2	47.3	50.2	d.	51.3	50	49.3	52.2	d.	48.4
Maximum width	24.2	23	24.8	23.2	22.5	23.5	23.1	23	23.5	22.5	24	23.6	23.1	23.1	d.	24
Interorbital space	21	20	20.2	20.2	19.8	20.2	19.6	d.	20.2	19.8	20.2	18	18.2	18.5	21	19.9
Zygomatic width	33.2	32.2	33.2	23.4	31.2	32.9	32	d.	33.2	31.6	33.7	33	31.1	32.1	32	31.2
Height at level of bullae osseae	23.1	23.2	20.1	23.2	22.9	22.5	22.8	22.6	22.3	24.1	23.1	23	22.2	22	23.1	22.3
Height in region of bony palate	15	13.9	14	34.5	12.9	14.0	14.5	15	15.8	13.1	15	12.8	14.2	14.2	14.9	14
Length of nasals	16.7	16.3	17.2	17.7	16	16.8	15.2	15.2	16	16.5	17.2	16.2	16.9	17.3	17	15.9
Length of braincase	29.1	28.8	29	29.8	28.2	29.0	27.7	28	30	29.2	29.8	29.1	28.2	28	—	29
Width of rostrum	10	8.9	10.9	9.6	10	9.9	9.9	9.6	9.9	10	10	9.1	9.2	9	8.6	8.9
Length of bullae osseae	12.8	11.7	11.8	11	10.2	11.6	11.1	11.3	12.3	10.6	11.2	10.3	10.9	11.1	—	11.2
Width of bullae osseae	8.8	10	9.9	9.2	8.9	9.4	9.2	8.6	9.2	8.2	9	8.2	8.9	7.9	—	8.2
Upper tooth row	9.8	9.2	9.9	9.7	9.3	9.6	10	9.5	9.4	9.2	9	9.6	9.9	10.3	9.2	9.9
Lower tooth row	9.1	9.3	9.3	9	9.1	9.2	10.1	9.4	9.2	8.6	8.5	8.7	10	9.8	9.3	9.8
Width of skull between infraorbital foramina	11.2	10.1	10.2	10.9	10.4	10.6	10.3	d.	10.8	10.1	11.5	10	10.1	11	12	10.2
Age, years	~4	~5	~4	~5	1	—	1	juven.	~3	1	>1	~2	juven.	>2	~2	Juvenis

TABLE 52

Measurements of squirrel Sciurus vulgaris L.

Subspecies	Sciurus vulgaris mantchuricus Thos.						Sciurus vulgaris rupestris Thos.										
	No. 103 ♀ 21 Oct. 1932. Bidzhan. Yu. Salmin	No. 113 ♀ 30 Oct. 1932. Ibidem	No. 102 ♂ 21 Oct. 1932. Ibidem	No. MII 65 (245) ♂ 15 Nov. 1935. Upper reaches of Eimanacha river, tributary of Bol'shaya Yadora river, forest, western slope of Great Khingan. A. S. Lukashkin	No. MII 66 ♂ 18 Nov. 1935. Ibidem	Sciurus vulgaris mantchuricus Thos. Average	No. M.3776 ♀ 15 May 1932. Sakhalin, Argi-Pagi, bank of Pagi river. A. Rekst	♀ 25 Aug. 1929. Sakhalin, commercial specimen. Mogi. Bromley	No. M.2140 ♂ 9 Apr. 1926. Yakshina river. Bol'shoi Shantar Island. G. D. Dul'keit	No. 2139 ♀ 30 Jan. 1925. Bol'shoi Anaur river, Bol'shoi Shantar Island. A. Baturin	No. M.2141 sex 9 Apr. 1925. Yakshina river, Bol'shoi Shantar Island. G. D. Dul'keit	No. M.2136 ♀ 9 Sep. 1925. Amuka river. G. D. Dul'keit	No. M.2135 ♀ 7 Aug. 1925. Ibidem	No. M.2137 ♂ 5 May 1925. Estuary of Amuka er. G. D. Dul'keit	No. 732 ♂ 9 Apr. 1926. Yakshina river. E. Borisov	No. 77 ♂ ad. 21 Feb. 1925. Shlyupochnaya river. G. D. Dul'keit	No. 125 ♀ 1 Apr. 1925. Ibidem
Length of body and head	—	—	—	255	—	—	—	240	—	—	—	217.7	209.4	204	—	—	—
Length of tail without terminal hair	—	—	—	200	—	—	—	165	—	—	—	186	165.7	173	—	—	—
Length of hind feet without claws	—	—	—	61.5	—	—	—	52	—	—	—	61.7	58.9	56	—	—	—
Length of ear	—	—	—	36	—	—	—	24.5	—	—	—	29	30.9	33.5	—	—	—
Length of skull	56.9	55	55.3	57	55.2	55.0	54.5	50.6	55.3	53.3	53.8	52.1	51.1		53.2	51.7	52.3
Basal length of skull	44.3	43	42.9	44.2	d.	42.9	40.6	39.9	d.	42.1	d.	39.1	40.1	40.7	40.8	40.2	40
Condylobasal length of skull	51.1	50.2	50	52	d.	50.1	48.2	46.1	50.3	50	d.	47	46.2	48.3	48.3	47.7	46.3
Maximum width	25.1	24.5	26.2	26	d.	24.0	24.3	25	23.1	23.8	22.2	23	22.3	22.6	22.7	22.7	22.2
Interorbital space	20.2	20.8	20	19.2	20	19.7	18.8	19.9	d.	19.5	18.5	18.2	19	19.2	19	19	19.2
Zygomatic width	31.8	31.2	32.2	32.2	31.5	32.0	31.4	30.1	31.1	32.5	31.2	30.1	29.9	31.2	31	30.2	31.1
Height at level of bullae osseae	24	22.3	24	22.3	d.	22.9	22.1	23.2	22	23	22	23	23	22.1	22	22.3	23
Height in region of bony palate	15	15	14.7	16.1	14.8	14.6	13.2	12.8	13.8	12.7	13	14.1	13.2	13.3	13.2	13.2	12.3
Length of nasals	16.6		16	17.5	18.7	16.6	16.2	15.1	17	15.6	15.6	15	14.5	—	16.5	15	14.7
Length of braincase	31.3	29.5	28.3	30.6	d.	29.1	28.3	27.2	28.2	29.1	28.3	28.2	28.1	29	27.5	27.7	27.7
Width of rostrum	9.2	9	9	9.5	9.2	9.3	8.2	8.2	8.9	9	9.2	9.1	8.9	9.5	9.1	9.2	8.2
Length of bullae osseae	12.2	11.3	11.2	12.7	—	11.3	10.6	12	12.2	12	10	11.2	11.2	10.2	11.7	10.7	11
Width of bullae osseae	9.1	8.6	9.2	8.2	—	8.6	8.5	8.9	9.2	8.2	8.2	8.2	8.7	8	8.1	8	9.7
Upper tooth row	10.1	9.8	10.1	10.4	10.2	9.8	10	10	10.1	9.8	9.8	10.1	9	10.2	9.8	9.2	9.7
Lower tooth row	9.9	9.9	9.7	10.2	9.8	9.5	9.5	9.1	9.9	9.6	9.6	9.5	8.8	10.1	9.1	9.8	9
Width of skull between infraorbital foramina	11.2	10.6	10.1	12	11.4	10.8	10	10	11	11.2	10.8	10.6	10	—	10	9.7	11
Age, years	Juvenis	1	Juvenis	Juvenis	Juvenis	—	1	Juvenis	>2	1½	>3	1	Juvenis	1	4½	3	1½

TABLE 53

Measurements of squirrel Sciurus vulgaris L.

Subspecies	Sciurus vulgaris rupestris Thos.												
	No. 85 ♂ 28 Feb. 1925. Anaur river, Bol'shoi Shantar Island. G. D. Dul'keit	No. 79 ♂ 22 Feb. 1925. Ibidem	No. 734 ♀ 9 Apr. 1926. Yakshina river. Bol'shoi Shantar	No. 54 ♀ 30 Jan. 1925. Anaur river	No. 65 ♂ 15 Feb. 1925. Ibidem	No. 92 ♀ 2 Sep. 1925. Ibidem	No. 80 ♂ 22 Feb. 1925. Yakshina river, Bol'shoi Shantar Island	No. 107 ♂ 23 Mar. 1925. Srednyaya river, Bol'shoi Shantar Island	No. 11 ♂ 7 Sep. 1932. Khor river, vicinity of Bichevaya. A. Pronin	No. 4 ♀ 6 Oct. 1932. Ibidem	No. 1 ♀ 6 Oct. 1932. Ibidem	No. 17 ♀ 13 Oct. 1932. Ibidem	Sciurus vulgaris rupestris Thos. Average
Length of body and head	—	—	—	—	—	—	—	—	230	283	246	260	236.3
Length of tail without terminal hair	—	—	—	—	—	—	—	—	205	190	190	197	184.0
Length of hind feet without claws	—	—	—	—	—	—	—	—	60	63	60	67	59.8
Length of ear	—	—	—	—	—	—	—	—	35	33	33	28	30.9
Length of skull	51.5	52	52.2	51.1	51	52.6	53	d.	53.2	52	54	54.9	52.6
Basal length of skull	40	40.7	40.7	39.2	40.2	41.2	41	41.3	41.9	40.3	43.1	43	40.8
Condylobasal length of skull	47.2	47.7	47.8	46.9	47.2	48.2	48.1	48.2	49.1	46.3	49.9	49.2	47.9
Maximum width	23	d.	23.7	23	23.2	23	23	23.2	23.2	24.1	23.6	23.6	23.2
Interorbital space	18.3	19	19	18.1	18.7	19	18	18.1	17.9	19	17.7	19.3	18.7
Zygomatic width	30.8	30	31.2	31.2	31	30.6	30.3	31.2	31	30	31	31.6	30.8
Height at level of bullae osseae	22.1	22.2	22.7	22.3	23.3	23.2	23	21.7	23.6	23	22.8	23.3	22.6
Height in region of bony palate	13.6	14	13	13	13	13.3	12.8	13.7	14.2	14	15.8	15	13.4
Length of nasals	16.1	16.5	16.5	16	16	16.7	15.5	d.	15.9	d.	16.6	17	15.9
Length of braincase	26.7	27.3	27.7	28	27.3	27.3	27.6	27.9	27.1	27.6	29	28.2	27.9
Width of rostrum	8.5	8.9	8.1	9	9.1	9	8	9	8.9	8	8.3	8.9	8.7
Length of bullae osseae	11	10.3	11.3	10.4	11.2	10.3	10.2	10	11.5	11.3	11.1	22.1	11.0
Width of bullae osseae	9.1	9	8.3	8.2	7.2	8	7.6	7.2	8.1	8.3	8	9.9	8.3
Upper tooth row	9	9.2	9.8	9.2	9.3	9.1	9.3	9.1	10	10.2	10.1	10.2	9.7
Lower tooth row	9	9.1	9.2	9.8	9.1	9	9.2	9.2	—	—	9.7	10	9.4
Width of skull between infraorbital foramina	10.2	10	9.3	10.3	10.3	10.6	10.1	10	11.1	11.3	11.2	10.6	10.4
Age, years	4	1	3	2	2½	2½	—	1½	1	—	—	2	—

TABLE 54

Measurements of Spermophilopsis leptodactylus Licht.

Subspecies	Spermophilopsis leptodactylus leptodactylus Licht.															
	No. 42 ♂ ad. 25 Apr. 1930. Karakul, Bukhara District. ZMAN collection	No. 38 ♀ 24 June 1930. Ibidem. ZMAN collection	No. 46 ♀ 27 Apr. 1930. Ibidem. ZMAN collection	No. 37 ♂ 27 Apr. 1930. Ibidem. ZMAN collection	No. — 19 Apr. 1930. Ibidem. ZMAN collection	No. 108 ♂ 8 May 1930. Khodzha-Davlet, Bukhara District. ZMAN collection	No. 1706 ♂ 20 Aug. 1925. Karakul Village, Zeravshan Region, sands. Dukel'skaya. S. I. Ognev's collection	No. 1707 ♀ 20 Aug. 1925. Ibidem. S. I. Ognev's collection	No. 22 ♂ 7 Apr. 1932. Uch-Adzhi station of Central Asian Railway. N. Lavrov and S. Naumov	No. 18 ♀ 21 Apr. 1932. Ibidem N. Lavrov and S. Naumov	No. 6733, 7 May 1932. S. 6733 (273). Karabata railway station, northwest of Merv [Mary]. A. Kuzyakin. ZMMU collection	S. 6735 ♀ 28 Apr. 1932. Ibidem. ZMMU collection	S. 6737 ♂ 2 May 1932 Ibidem. ZMMU collection	S. 6738, 1 May 1932. Ibidem. ZMMU collection	S. 6736 ♀ 28 Apr. 1932. Ibidem. ZMMU collection	S. 6742 ♀ 25 Apr. 1932 Ibidem. ZMMU collection
Length of skull	54	55.3	55.3	55	55	55	55.1	54.2	53.2	54.5	58	53.2	55	53.2	54.8	53.2
Condylobasal length	48.3	51.3	49.8	50.7	50.6	49.6	50	49.2	48.2	49.7	d.	49.2	50.6	49.5	50.2	49.2
Zygomatic width	34.3	36	33.5	33.3	33.6	33.6	33.1	34	33.2	35.2	36.5	32.9	34.8	33	35.2	35
Interorbital width	17	18	17	16.6	17	15.7	15.2	15	16.9	15.2	18	15.3	16.8	16.1	17	17
Width posterior to supraorbital processes	21.3	21.6	20.2	21.2	20.6	20.3	21.6	20	21.3	21	21.2	21.2	22	d.	21.6	20.6
Temporal width	25.3	26	25.1	24.2	25.2	25.2	25.1	24.1	24	24.3	26.1	24.6	25.6	25	26.3	25.6
Width between infraorbital foramina	11.3	d.	11.3	11.8	11.5	11.1	12	11.2	11.2	12.2	12.8	11.2	12.7	11.2	12.1	11.2
Length of nasals	19.8	19.3	20.3	20.2	19.8	20.2	19.2	20.1	21	20.3	23.2	19.5	21.8	19.8	20.3	20.2
Width of nasals	6.1	6.6	6.2	6.3	6.7	6.1	6.1	6.5	7	7	6.7	6.2	7.1	7	6.2	6
Length of upper diastema	10.1	12.6	10.2	10.9	11.9	11.3	11.6	12	11	11.6	—	10.2	11.2	10.3	10.6	10
Length of bullae osseae	11.6	12.7	11.8	12.2	12.7	11.6	11.2	11.1	12	12.4	13.2	12.2	12.2	12.3	12.2	11.9
Width of bullae osseae	12.3	14.6	13	13	12.9	13	11.6	12.1	12.2	13.2	14.6	13.2	13.2	12.4	14	12.5
Length of bony palate	24.1	27	24.8	24.7	25.6	26	25.3	24.5	23.8	26.2	—	24.6	25	24.2	26.7	24.6
Length of upper tooth row	11.2	10.2	11.8	11.2	11.2	11.3	10.5	9.8	10.8	10.9	11	10.7	11.2	11.3	11.2	11.1
Length of body	240	240	235	305	225	248	228	235	235	255	260	233	256	—	242	255
Length of tail	72	85	75	85	72	d.	73	102	65	60	60	67	60	—	71	70
Length of hind feet	59.8	60	59	60	58.4	56	64	57	55	55	60	57	58		58	57
Length of ear	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Teeth	worn	worn	strongly worn	strongly worn	strongly worn	worn	worn	strongly worn	worn	worn	strongly worn	worn	strongly worn	worn	—	strongly worn
Weight												520 g			605.g	

TABLE 55

Measurements of Spermophilopsis leptodactylus Licht.

Subspecies	Spermophilopsis leptodactylus leptodactylus Licht.													Sp. l. schumakovi Satun.						Sp. l. subsp.	
	S. 6732, ♂ 22 Apr. 1932. Karabata village, near Merv [Mary] solonchak takyr. A. Kuzyakin. ZMMU collection	S. 4491, ♀ Southern Bukhara near Yangi-aryk. N. Bobrinskii, ZMMU collection	♂ 4 Apr. 1926. Zeravshan Region, Karakum. ZMMU collection	M 3233 (6) ♀ 4 May 1925. Sands, vicinity of Ashkhabad. S. I. Ognev	M 3235, ♂ 4 May 1925. (7) Ibidem	M ♂ 4 May 1925. (4) Ibidem	M 3232, ♀ 20 May 1925. (109) Vicinity of Annau. S. I. Ognev	M, ♀ 4 May 1925. Vicinity of Ashkhabad. S. I. Ognev	♀ 4 May 1925. Ibidem. S. I. Ognev	M 3239, ♂ 13 July 1925. (329) Ibidem. S. I. Ognev	No. 9 ♂ 4 Mar. 1932. Krasnovodsk District, Ak-Kuyu well, 60 km from Dzhebel station S. Naumov and A. Lavrov	No. 4 ♀ 27 Feb. 1932. Vicinity of Dzhebel station, Krasnovodsk District. S. Naumov and N. Lavrov	Spermophilopsis leptodactylus leptodactylus Licht. Average	No. 54, ♀ ad. 25 June 1933. Kushka. Turkmenian Parasitological Expedition. ZMAN collection	♂ ad. 13 July 1933. Ibidem. ZMAN collection	No. 75, ♂ ad. 2 July 1933. Ibidem. ZMAN collection	No. 48, ♂ ad. 23 June 1933. Ibidem. ZMAN collection	No. 5103, Kushka. K. A. Satunin. ZMMU collection	Sp. l. schumakovi Satun. Average	No. 15, ♀ 26 Mar. 1932. Vicinity of the Semye Hillocks, Central Kara-Kums. S. Naumov and N. Lavrov	No. 17, ♀ 27 Mar. 1932. Ibidem
Length of skull	54.9	58.2	55.3	54.5	54	53.1	53.4	53.2	54.2	55	53.8	53	54.5	56.3	59	58.6	59.2	58.3	58.3	50	—
Condylobasal length	49.6	53.5	49.3	49.2	47.8	48.3	48.9	49.7	49.6	50.2	49	47.8	49.6	51.6	54	54	53.7	52.1	53.1	44.2	—
Zygomatic width	d.	36.6	34.8	35.3	—	34	33.8	33.2	34.9	35.2	35	33	34.3	36	38.6	37.3	38.3	37.5	37.5	31	—
Interorbital width	16.9	16.2	16.2	16.4	13.6	—	15.5	14.4	15.2	14.9	15.2	14.9	16.0	17.8	19.3	18.3	20.1	15.5	18.2	13.4	—
Width posterior to supraorbital processes	22.2	22.3	21	21.6	20.2	—	20.1	21	20.2	19.4	21.9	21.1	21.0	20.5	22.3	21.6	22.3	21.2	21.6	19.7	—
Temporal width	26.1	26	26.3	25.2	24.3	23.7	24.3	23.8	24.5	24.9	25	24.2	25.0	25.2	28	28.2	27	27.5	27.2	24	—
Width between infraorbital foramina	12	13	11.5	—	—	—	—	—	—	—	12	11.3	11.7	12.2	12.8	12.6	13.8	13	12.9	10.6	—
Length of nasals	20.2	22.1	20.9	19.5	18.8	17.8	20.2	19.2	20.6	21.2	20.5	19	20.2	20.1	22.3	22.8	24.3	21.2	22.1	18.6	—
Width of nasals	7	7.1	7	—	—	—	—	—	—	—	7	6.5	6.6	7.2	8.2	7.5	7	6.9	7.4	6.1	—
Length of upper diastema	12.2	13.1	11.3	11.7	12	11.8	11.8	12.2	12.5	11.2	10.9	11	11.4	12	12.8	12.3	13.2	12.1	12.3	10	—
Length of bullae osseae	12.6	11.3	12.7	—	—	—	—	—	—	—	12	12.1	12.1	12	14	—	—	13.2	13.1	10.8	—
Width of bullae osseae	12.8	13	13.2	—	—	—	—	—	—	—	13.1	13	13.0	13.2	14.8	—	—	13.3	13.8	11.2	—
Length of bony palate	—	28.3	26.2	—	—	—	—	—	—	—	24.6	24.5	25.3	—	—	—	—	26.1	26.1	23	—
Length of upper tooth row	11.2	12.2	10.6	11.2	10.8	11	11.5	10.9	11.4	11.5	10.2	10.2	11.0	12	11.6	11.3	—	12	11.7	10.3	—
Length of body	250	—	231	232	231	226	220	222	227	207	225	225	238.0	237	253	266	278	—	258	210	225
Length of tail	55	—	85	67	64	48	66.2	67	43	50.6	50	56	66.8	74.1	65.5	67	65.2	—	68.0	55	70
Length of hind feet	55	—	53	57	51.5	57.2	55	53.5	54.5	52.1	55	67	57.1	56	59.3	60.6	60.1	—	59.0	49	56
Length of ear	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Teeth	worn	strongly worn	worn	—	—	—	—	—	—	strongly worn	strongly worn	—	—	strongly worn	very worn	strongly worn	worn	rather worn	—	strongly worn	—
Weight	620 g	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE 56

Measurements of body and skull of Eutamias sibiricus Laxm.

Subspecies	Eutamias sibiricus sibiricus Laxm. ♂♂																	
	No. 1823 (No. 677) ♂ 23 Aug. 1929. Pikhtovka Village, Ridder [Leninogorsk] District, Semipalatinsk Region. B. A. Kuznetsov	No. 1824 (678) ♂ 25 Aug. 1929. Ibidem	No. 1821 (675) ♂ 23 Aug. 1929. Ibidem	No. 1810 (539) ♂ 4 Aug. 1929. No. 1819. Ibidem	No. 1819 (646) ♂ 21 Aug. 1929. Ibidem	♂ 27 Sep. 1930. Troitsk District, West Siberian Territory. Petrovskoe Lake. V. V. Gubar'	No. 95 sex 12 Oct. 1930. Ibidem	No. M 1344 ♂ 18 Aug. 1925. Turukhansk Territory. Kureika river. F. Shillinger. S. I. Ognev's collection	6 Aug. 1928. Southern Altai, bank of Bukhtarma. Razorenov	♂ 11 Aug. 1928. Ibidem	♂ 10 Aug. 1928. Ibidem	♂ 11 Aug. 1928. Ibidem	No. 272 ♂ 22 Apr. 1931. Srostki pine forest, former Zmeinogorsk County, Tomsk Province. Gol'tsmaier	No. M 3928 ♂ 12 July 1928. Near Monok village, 170 km southwest of Minusinsk. N. M. Dukel'skaya, S. I. Ognev's collection	No.-M 3929 ♂ 22 June 1928. Ibidem	No. M 3932 ♂ 5 June 1928. Ibidem	No. M 3934, 6 June 1928. Ibidem	No. M 3935 ♂ 1 June 1928. Ibidem
Length of body and head	168	145	156	158	154	131	146	—	127	145	140	145	—	150.7	145	151.5	142	145
Length of tail	106	d.	104	114	112	—	100	—	112	105	111	105	—	105.1	109	92.3	—	79
Length of hind feet	33	32	34	36	36	37	—	—	—	35	31	35	—	35	34	35.2	35.5	33.7
Length of ear	17	—	17	17	18	14	12	—	17	14	17	14	—	14.6	16.7	16.3	15.4	14.6
Length of skull	40.1	37.6	39.8	40	38.9	39	38.2	38.9	39.8	39.3	38	40.9	38.6	39.2	38.2	40.2	39	38
Basal length of skull	30.3	29.6	—	32.3	30.3	30.1	30.1	30.6	30	31	29.2	32.6	30.3	31.2	30.8	31	31	30.2
Condylobasal length of skull	36.2	34.7	36.2	38.5	36.6	35	34.7	36	35.5	36	34.2	37.4	35.2	36.2	35.3	36.2	36	35.5
Interorbital space	10.7	9.8	10.1	—	10	9.6	9.7	11.1(!)	9.8	10	9.3	10.6	10.2	10.3	10.2	10.8	10.6	10.2
Greatest width of skull	17.8	17	—	17.6	17.2	17.6	17.4	17.6	17.9	18.2	17.9	18.1	17.2	17.6	17.2	18	16.9	17.8
Zygomatic width	22.1	21.3	22.1	22.8	20.9	21.2	22	23	22	22.6	21.2	22.6	22.1	22.9	21.5	22.2	22.3	22.2
Height at level of bullae osseae	15	15	15.3	15	16	15.2	15.2	15.2	14.8	14.2	15.6	15.2	15	15.3	14.8	15	15	14.9
Height of bony palate	9.2	9.8	9	8.9	9	9	8.6	9.3	9.3	9.2	8.9	8.9	9	9.1	9.2	10	9.3	8.8
Length of nasals	13.1	11.8	12.5	13	12.6	13	12.2	12.3	12.9	13.2	11.6	12.3	12.6	12.7	11.5	12.5	12.5	12.2
Length of braincase	20.1	19.6	20.6	20.5	20.6	20	20.2	19.7	20.9	20.2	20.2	21.1	20	20.1	20	20.2	20.2	19.5
Width of rostrum	5.8	5.5	5.9	6.5	6.1	6	5.8	5.8	6.6	6.7	6.2	6.1	6	6	6.3	6.3	6.1	5.9
Length of bullae osseae	8.2	8	8.3	9.2	8.8	9	8.2	8.1	8.3	9	8.8	8.9	8.2	8.9	8.3	9	8.9	8.8
Width of bullae osseae	6.5	6.7	7.1	7	7	6	6.2	6.2	6.2	6.7	6.6	7.2	6.3	6.2	6.2	6.3	6.2	6.1
Length of upper tooth row	6.2	6.2	6.5	6.7	7	6.1	6.7	6.6	6.5	6.1	6.1	6.2	6.2	6.3	6.3	6.2	6.2	6.1
Length of lower tooth row	6	5.9	6.1	5.9	5.9	6	6.6	6.1	—	5.9	6.1	6	6.1	6	6.1	5.9	6.1	6.1
Width of infraorbital foramina	8.8	8.1	8.3	8.3	8.2	8.3	8.8	8.2	8.7	8.9	8.6	8.9	8.8	8.6	8.3	8.8	8.8	8.3
Age	Senex	Adult.	Adult.	Senex	Adult.	Adult.	Adult.	Senex	Adult.	Senex	Adult.	Adult.	Adult.	Adult.	Adult.	Adult.	Senex	Senex
	Teeth strongly worn	Teeth worn. Fully grown	Teeth not worn	Teeth strongly worn	Teeth not worn	Teeth not worn	Teeth not worn	Teeth strongly worn	Teeth not worn	Teeth strongly worn	Teeth not worn	Teeth slightly worn	Teeth not worn	Teeth not very worn	Teeth not very worn	Teeth not very worn	Teeth worn	Teeth very worn

TABLE 57

Measurements of body and skull of Eutamias sibiricus Laxm.

Subspecies	Eutamias sibiricus sibiricus Laxm. ♂♂ and ♀♀																	
	No. 799 (191) ♂ 9 July 1928. Zyulzikan village, Transbaikalia. B. A. Kuznetsov	No. 798 (126) ♂ 15 July 1928. Kyker village, Transbaikalia. B. A. Kuznetsov	No. 806 (231) ♂ 15 July 1928. Ibidem	No. 833 (291) ♂ 19 July 1928. Ibidem	Average, males	No. 1808 (537) ♀ 4 Aug. 1929. Pikhtovka village, Ridder [Leninogorsk] District, Semipalatinsk District. B. A. Kuznetsov	No. 1825 (162) ♀ 22 Aug. 1929. Ibidem	No. 1813 (547) ♀ 6 Aug. 1929. Ibidem	No. 1816 (589) ♀ 10 Aug. 1920 Katon-Karagai (Altai). B. A. Kuznetsov	No. 1817 (596) ♀ Ibidem	No. 1818 (597) ♀ Ibidem	No. 1815 (551) ♀ 7 Aug. 1929. Ibidem	No. 3933 (95) ♀ 13 June 1928. Monok village, 170 km southwest of Minusinsk. N. M. Dukel'skaya	M 3931 (150) ♀ 28 June 1928. Ibidem	No. 819 (250) ♀ 16 Aug. 1928. Kyker village, Transbaikalia. B. A. Kuznetsov	No. 839 (317) ♀ 20 July 1928. Ibidem	No. 774 (8) ♀ 19 June 1928. Kalinino village, Transbaikalia. B. A. Kuznetsov	No. 817 (248) ♀ 16 June 1928. Kyker village, Transbaikalia. B. A. Kuznetsov
Length of body and head	153	—	162	142	147.4	144	154	150	150	162	144	155	147.5	152	162	149	149	150
Length of tail	102	—	111	112	105.0	99	112	112	111	115	111	113	111	104	d.	104	109	109
Length of hind feet	34	—	34.4	35.2	34.5	35	36	37	36	36	37	35	35.7	33.3	34.2	33.8	34.8	35.2
Length of ear	17	—	17	10.4	15.5	15	17	16	16	16	16	16	15.7	15.7	17.3	17.3	16	17.3
Length of skull	38.8	38.5	39.7	38.2	39.0	37.7	39.9	38.7	40.2	41	39	40.2	40.2	38	39.2	38.4	39.3	38.8
Basal length of skull	30.3	—	30.4	29.7	30.6	29.2	30.7	31	32.1	32	30.6	31.7	31.8	29.3	31	29.6	30.8	30.8
Condylobasal length of skull	35.7	35.1	36.2	34.8	35.8	34	36	35.2	37.2	37.2	35.2	37.1	37	35	36	34.9	36.1	36.1
Interorbital space	17.2	d.	17	16.7	17.5	17	18.2	18	18	18.2	17.1	17.5	18	17.5	18.2	16.2	16.2	16.8
Greatest width of skull	10.7	10.3	10.4	10.3	10.2	9.6	10.2	9.9	10.6	10.7	9.6	10.6	10.8	—	10.2	9.8	10.4	10.7
Zygomatic width	22.7	21.1	22.2	21.1	22.0	21.7	22.7	22.5	22.2	23.1	21.3	22.4	22.2	22.2	21.6	21.3	22.2	22.3
Height at level of bullae osseae	14.4	14.6	14.9	14.7	15.0	15.2	15.5	15.2	15.2	15.6	15	15.2	13.3	15	14.7	14.1	14.9	14.1
Height of bony palate	9.8	9.1	10	9.6	9.2	8.7	9	8.9	9.5	10.2	10	9.5	9.5	9.5	9.6	8.7	9.8	8.7
Length of nasals	12	12.7	12.9	11.8	12.4	11.8	13	12.3	13.2	13	12	13.7	13	11.6	12.3	12	13.4	12.6
Length of braincase	20	20	20.3	20	20.2	19.6	20.7	20.2	20.7	20.8	20.2	20.3	20.5	20	20.2	19.9	19.9	19.7
Width of rostrum	5.9	5.7	5.8	5.2	6.0	5.3	6.2	6.8	6.9	6.6	5.6	6.1	6	6	6.2	6.3	6.2	6.2
Length of bullae osseae	8.1	8.9	8.1	8.1	8.6	8.1	8.6	8.2	8.9	9.2	8.3	9	8.4	8	8.2	8.7	8.5	8.3
Width of bullae osseae	6.7	7	7.2	6.2	6.5	6.5	6.6	6.8	7	7.2	6.6	7.2	6.7	6.8	7	6.7	6.3	6.7
Length of upper tooth row	6.1	6	6.3	6.1	6.4	—	6.2	6.2	6.2	6.6	6.7	6.1	6.5	6.1	6.7	6.1	6.2	6.2
Length of lower tooth row	5.8	6.1	6.1	6.2	6.0	5.9	6.1	6.1	6	6.2	6.1	6	6.1	5.8	6.2	5.9	6.2	6.1
Width of infraorbital foramina	8.3	8	8.1	8.3	8.5	8.2	8.3	d.	8.9	8.8	8.1	8.7	8.6	8.3	8.7	8.2	8.9	8.2
Age	Senex	Senex	"—"	Adult.		Adult.	Adult.	"—"	Senex	"—"	Adult.	Senex	Senex	Adult.	Senex	Senex	"—"	Adult.
	Teeth strongly worn	Teeth worn		Teeth not worn		Teeth moderately worn	Teeth not worn		Teeth worn		Teeth moderately worn	Teeth strongly worn	Teeth moderately worn	Teeth moderately worn	Teeth worn	Teeth strongly worn		Teeth slightly worn

TABLE 58

Measurements of body and skull of Eutamias sibiricus Laxm.

Subspecies	Eutamias sibiricus sibiricus Laxm.				E. sibiricus striatus Pall.														
	No. 830 (282) ♀ 18 July 1928. Kyker village, Transbaikalia. B.A. Kuznetsov	M.1219 ♀ 28 June 1924. Sosnovka, Barguzin Reserve. Z. Svatosh, S.I. Ognev's collection	Average, females	Average of population	No. 44 ♂ 18 July 1932. Ponur village, Surgut District. I.D. Kiris. ZMUU collection	No. 42 ♂ 18 July 1932. Ibidem	M.155 ♂ June 1916. Polyudov Kamen', Ural, near Cherdyn'. S.I. Ognev	No. 87 ♂ 4 June 1934. Mozhga District, Uralsk Region. Collection of the Volga-Kama Station	No. 185 ♂ 29 June 1934. Ibidem	No. 253 ♂ 13 July 1934. Ibidem	No. 119 ♂ 13 June 1934. Ibidem	No. 295 ♂ 21 July 1934. Ibidem	No. 46 ♂ 16 May 1934. Ibidem	No. 308 ♂ 27 July 1934. Ibidem	No. 431 ♂ 30 Aug. 1934. Ibidem	No. 470 ♂ 9 Sep. 1934. Ibidem	No. 45 ♂ 16 May 1934. Ibidem
Length of body and head	146	160	151.6	149.2	138.4	130.8	—	150	151	140	154	160	145	150	150	145	145
Length of tail	108	105	108.8	106.8	104.3	105.6	—	108	111	110	110	—	117	107	110	107	110
Length of hind feet	34.6	—	35.3	34.8	34.4	30.5	—	38	35	34	35	34	36	35	36	—	34
Length of ear	17.1	18	16.4	15.9	17.3	15	—	—	—	—	—	—	—	—	—	—	—
Length of skull	37.6	39.3	39.2	39.1	38.6	38.5	39.1	39	38.8	38.6	38.7	39.3	38.6	38.8	39.8	39.2	39
Basal length of skull	29.1	31.3	30.7	30.6	30.2	—	30.3	30.3	30.2	29.3	29.8	30.7	30.2	30.4	30	31.3	30
Condylobasal length of skull	33.9	37.2	35.9	35.8	36	34.6	35.8	36.2	36.1	35.6	35	36	35.3	35	36.1	36.1	35.2
Interorbital space	16.4	18	17.4	17.5	17.6	17.1	18	17.2	17.3	17.3	18	18.2	17.2	17.3	18	17.7	17.7
Greatest width of skull	9.7	10.9	10.2	10.2	10.2	9.2	10.1	10.5	9.8	10.3	10.8	10.7	10.6	10.3	10.8	10.6	10.7
Zygomatic width	20.8	22.2	22.0	22.6	22.3	21	22	21.3	21.1	21.1	21.8	21.5	22.1	22	22.1	22.1	21.7
Height at level of bullae osseae	14.8	14.3	14.8	14.9	14.6	15.5	15.3	14.9	13.3	14.3	15	15	15	15	14.9	14.2	14.3
Height of bony palate	8.5	9.2	9.3	9.2	8.9	8.9	9.2	9	9.8	9.2	9.2	9.9	8.5	9.3	9.3	9.5	9.6
Length of nasals	11.2	12.9	12.5	12.4	13.8	10.9	12.4	12.6	13.2	12.6	12.5	12.1	11.6	11.5	13	13.1	12
Length of braincase	19.3	20.2	20.1	20.2	19.3	20	20	20.7	20.6	19.8	20.2	20.7	20.1	20.6	20.6	20.3	20
Width of rostrum	5.3	—	6.1	6.0	6.2	5.1	5.9	5.3	5.6	5.6	5.7	5.3	5.9	6.4	6.1	5.3	5.8
Length of bullae osseae	8.5	8.3	8.5	8.6	8.1	8	8.3	9	8.8	8.3	8.9	8.2	9	8.3	9.2	9.1	8.2
Width of bullae osseae	6	6.9	6.7	6.6	6.2	6.1	7	6	6.2	6.3	6.8	7	6.3	6.4	6.8	7	6.2
Length of upper tooth row	6.3	6.3	6.3	6.4	6	6.6	6.2	6.1	6.1	6.2	6.3	6.6	6.1	6.2	6.3	6.3	6.7
Length of lower tooth row	6.2	6.2	6.1	6.0	6.1	5.7	6	—									
Width of infraorbital foramina	8.1	8.2	8.4	8.5	8.6	8.1	8.3	8.8	8.3	8.3	8.3	8.6	8.8	8.7	8.9	8.7	8.7
Age	Adult.	Senex			Adult.	"—"	Senex	Adult.	Senex	Adult.	Adult.	Senex	Adult.	Adult.	Adult.	Adult.	Adult.
	1	Teeth strongly worn			Teeth not worn		Teeth worn	Teeth moderately worn	Teeth strongly worn	Teeth worn	Teeth hardly worn	Teeth strongly worn	Teeth hardly worn	Teeth hardly worn	Teeth hardly worn	Teeth worn	"—"

TABLE 59

Measurements of body and skull of Eutamias sibiricus Laxm.

Subspecies	Eutamias sibiricus striatus Pall.																E. sibiricus jacutensis Ogn.	
	No. 93 ♀ 5 June 1934. Mozhga District, Uralsk Region. Collection of the Volga-Kama Station	No. 30 ♀ 10 May 1934. Ibidem	No. 28 ♀ 7 May 1934. Ibidem	No. 507 ♀ 19 Nov. 1934. Ibidem	No. 386 ♀ 18 Aug. 1934. Ibidem	No. 325 ♀ 31 July 1934. Ibidem	No. 134 ♀ 17 June 1934. Ibidem	No. 101 ♀ 9 May 1934. Ibidem	No. 287 ♀ 21 July 1934. Ibidem	No. 347 ♀ 18 Aug. 1934. Ibidem	No. 298 ♀ 25 July 1934. Ibidem	No. 78 ♀ 19 July 1932. Vynchina, Surgut Territory. I. D. Kiris	No. 46 ♀ 18 July 1932. Ibidem	Average, males	Average, females	Average of whole population	No. M.2215 ♂ 11 Sep. 1927. Vicinity of Yakutsk. K. E. Vorob'eva. S. I. Ogn. 's collection	No. M.2216 ♂ 9 Sep. 1928. Ibidem
Length of body and head	155	148	157	157	—	160	150	154	150	155	157	146	155	146.6	153.7	150.1	—	—
Length of tail	107	105	110	114	—	113	118	115	115	112	115	113	110	109.1	112.2	110.7	—	—
Length of hind feet	35	33	36	36	—	35	37	36	35	36	36	39	35.7	34.7	35.8	35.2	—	—
Length of ear	—	—	—	—	—	—	—	—	—	—	—	16.4	19	16.2	17.7	16.9	—	—
Length of skull	39.1	40	39.8	39.9	39.6	39.3	39.5	38.2	39.9	39.3	39.3	39.9	40.2	38.9	39.5	39.2	39	38.8
Basal length of skull	30.8	30	30.9	30.7	30.6	30	30.2	28.3	30.9	29.8	30.2	30.5	31	30.2	30.3	30.3	30	—
Condylobasal length of skull	36	35.9	37.3	36.8	36.5	36.3	35.3	34.3	36.2	35.2	35.3	36.2	36.1	35.6	36.0	35.8	35	36
Interorbital space	17.9	17.7	17.2	17.1	17.6	16.7	17	16.7	18.2	17.8	17	18.1	17.5	17.6	17.4	17.5	18.2	18.1
Greatest width of skull	11	10.7	10.3	10.7	11	10.3	10.8	10.3	19.6	10	10.3	10.2	10.2	10.4	10.5	10.4	10.6	11
Zygomatic width	21.4	21.7	21.3	21.6	21.3	21.6	21.2	21	22	21.6	21.3	21.2	22	21.7	21.5	24.6	22.1	22.6
Height at level of bullae osseáe	14.3	14.3	14.3	15	15	15	14.8	14.2	14.8	14.6	14.2	15.2	15	14.7	14.7	14.7	15	15
Height of bony palate	8.7	9.3	9.2	9.2	9	9	8.7	8.6	9.2	9	9.3	8.3	8.9	9.2	9.0	9.1	8.9	9.1
Length of nasals	12.6	—	12.3	12.6	12.2	12.1	13	11.8	12.3	12.7	12.3	12.8	12.5	12.4	12.4	12.4	11	12.2
Length of braincase	20.3	20.2	20.3	20.2	21.2	20.9	20.9	20	21	19.9	19.7	20.6	20.6	20.2	20.4	20.3	19.9	20.1
Width of rostrum	5.7	5.8	5.6	5.9	5.6	5.3	5.4	5.9	5.3	5.3	5.8	6.1	5.1	5.7	5.6	5.6	6.1	—
Length of bullae osseae	8.8	8.7	9	8.6	8.5	8	8.5	8.3	8	8.2	8.2	8.3	8.6	8.6	8.4	8.5	8.1	8.2
Width of bullae osseae	6.7	6.1	7	6.7	6.6	6.2	6.5	6.3	6.2	6.2	6.2	6.5	6.6	6.5	6.4	6.5	6.5	6.9
Length of upper tooth row	6.2	6.2	6.2	6.2	6.1	6.3	6.2	6.9	6.3	6.9	—	6.2	6.2	6.3	6.3	6.3	6.7	6.9
Length of lower tooth row	—	—	—	—	—	—	—	—	—	—	—	6	6.1	5.9	6.5	6.0	6.1	6.3
Width of infraorbital foramina	9	8.5	9.1	9	9	9	8.3	8.3	8.8	8.3	9	8.8	8.9	8.5	8.8	8.6	8.6	d.
Age	Senex	Adult.	Adult.	Adult.	Adult.	Adult.	Adult.	Adult.	Adult.	Adult.	Adult.	Adult.	Adult.				Adult.	Senex
	Teeth strongly worn	Teeth not worn	Teeth not worn	Teeth not very worn	"—"	Teeth hardly worn	Teeth worn	Teeth hardly worn	Teeth markedly worn	Teeth hardly worn	Teeth not worn	Teeth not worn	Teeth not worn				Teeth not worn	Teeth worn

TABLE 60

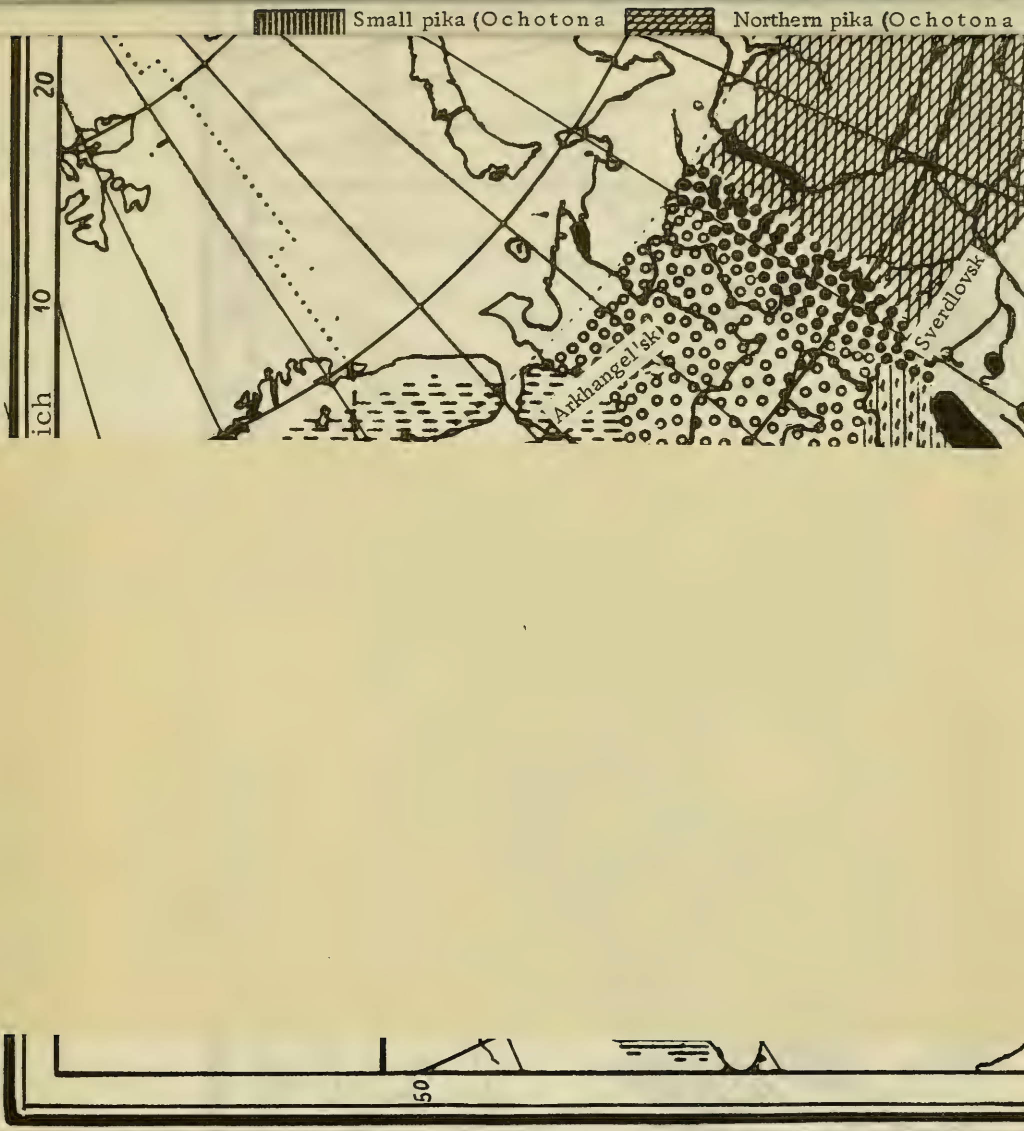
Measurements of body and skull of Eutamias sibiricus Laxm.

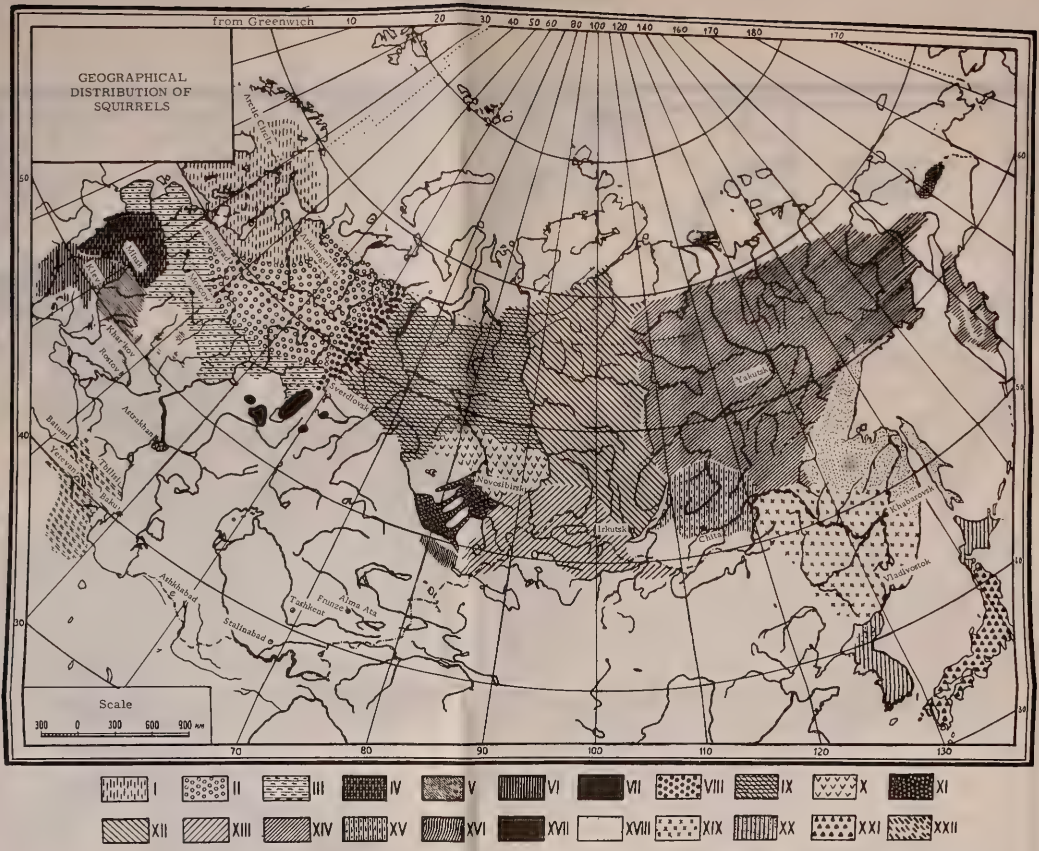
Subspecies	Eutamias sibiricus jacutensis Ogn.																
	No. S. 5549, 24 July 1928. Upper reaches of Amutkana river, 60 km north of Khatym. Pavlov-Silvanskii, ZMMU collection	No. S. 5539, 12 July 1928. Ibidem	No. S. 5537, 14 July 1928. Ibidem	No. S. 5538, 23 July 1928. Ibidem	No. S. 5544, 25 July 1928. Ibidem	No. S. 5534, 16 July 1928. Ibidem	No. S. 5533, 24 July 1928. Ibidem	No. S. 5545, 17 July 1928. Ibidem	No. S. 5536, 31 July 1928. Ibidem	No. S. 5532, 13 July 1928. Ibidem	No. S. 5640 July 1928. Ibidem	No. S. 5641 July 1928. Ibidem	No. S. 5558, 12 July 1928. Ibidem	No. S. 5636 July 1928. Ibidem	Average of population	No. M 1235 ♂ 26 Apr. 1910. Yevseevka village, Iman County, Maritime Territory. N. F. Ikonnikov. S. I. Ognev's collection	No. M. 1225 ♂ 23 May 1910. Ibidem
Length of body and head	—	—	—	—	—	—	—	—	—	150	—	—	—	—	—	—	—
Length of tail	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of hind feet	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of ear	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Length of skull	39.7	39.9	39.2	39.9	39.2	37.9	39.9	40	39.2	41 (:)	39.6	39.1	40.2	39.2	39.5	39.3	41
Basal length of skull	31.4	30.9	31	31	30.7	29	30.7	31.3	31.2	32.2	31	—	32.2	31	31.0	32.1	32.8
Condylobasal length of skull	36.5	35.9	34.7	35.6	35.2	34.5	36.1	36.3	35	36.2	36.2	35.5	36.5	35.2	35.6	37.1	27.7
Interorbital space	18	18.9	18.9	17.2	17.6	17.8	17.1	18.5	18	18.3	17.2	17.6	18.8	18	18.0	17	19
Greatest width of skull	11.2	10.3	11	11.2	11.3	10.6	11.6	11.6	11.2	10.3	10.5	10.5	11.6	11.1	11.0	10.3	11.3
Zygomatic width	22.1	21.6	22	22.3	22.2	21.2	22	22.1	22.2	22.5	21.2	21.6	22.1	22	22.0	22.2	23.2
Height at level of bullae osseae	15	14.2	14.9	14.2	14.3	14.6	14.3	14	14.2	14.6	14.1	14	14.8	14.6	14.5	14.7	14.7
Height of bony palate	8.5	8.6	9.1	8.6	8.9	8.2	8.2	9.6	8.4	9.1	9.2	8.6	8.7	9.2	8.8	9.2	9.8
Length of nasals	13	12.3	12.2	13.2	13.2	12.7	12.3	13.2	12.8	13	12.3	12.5	13.7	13.2	12.7	13.2	14
Length of braincase	20	20	20	20.2	20.1	19.2	20.5	20.7	19.6	20.5	20.1	20	19.9	19.7	20.0	20.1	20.6
Width of rostrum	6.2	6.1	5.5	6.2	6.1	5.5	6.2	6.1	6.2	6	6	6.1	6.2	6	6.0	6.1	6.9
Length of bullae osseae	8.6	8.2	9	8.9	8.1	8.3	8	8.3	8.3	8.8	9	9.1	9	8.8	8.5	8.3	9.3
Width of bullae osseae	6.2	6.1	6.9	6.1	6.1	6.2	6.2	6.8	6.2	6.6	6.2	6.1	7.2	6.5	6.4	6.1	6.5
Length of upper tooth row	7	6.3	6.2	6.1	6.9	7	6.5	6.2	6.1	6.2	6.3	6.8	6.9	6.5	6.5	6.1	6.3
Length of lower tooth row	6.9	6.1	6.2	6	6.3	6.2	6.2	6.1	6	6.1	6.5	6.2	6.2	6.1	6.2	6.1	6.1
Width of infraorbital foramina	8.2	8.1	8.2	8.7	8.6	8.3	8.7	8.9	8.2	8.2	9	8.4	8.6	8.6	8.5	—	9
Age	Yearling			Adult.	Yearling	Yearling	Yearling	Yearling	Senex		Senex	Adult.	Adult.	Adult.		Adult.	Senex
	Teeth not worn	Teeth not worn	Teeth not worn	Teeth not very worn	Teeth not worn	Teeth not worn	Teeth not worn	Teeth not worn	Teeth worn	Teeth not worn	Teeth strongly worn	Teeth not worn	Teeth not worn	Teeth not worn		Teeth not worn	Teeth worn

TABLE 61

Measurements of body and skull of Eutamias sibiricus Laxm.

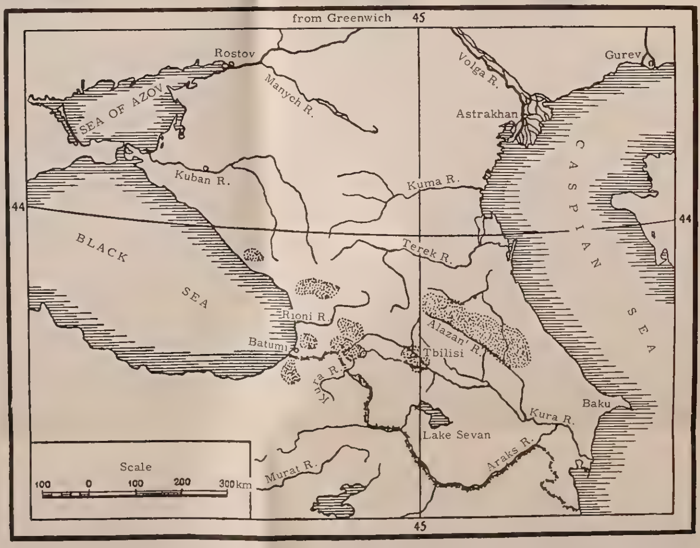
Subspecies	Eutamias sibiricus orientalis Bonhote								E.s. lineatus Siebold				
	No. M.1750 ♀ 18 June 1927. Steklyapukha Village, Shkotovo Subdistrict, Olga County, Maritime Territory. Dukel'skaya. S.I. Ognev's collection	No. M.1343 ♀ 27 June 1910. Yevseevka village, Iman County, Maritime Territory. N.F. Ikonnikov, S.I. Ognev's collection	No. M.1227 ♀ 9 May 1910. Ibidem	No. M.1228 ♀ 1 July 1910. Ibidem	No. M.3936 ♀ 22 Apr. 1910. Ibidem	No. M.1233, 25 June. 1910. Ibidem	No. 2860 ♀ 7 July 1913. Ussuri Territory. Lyubke and Pattser. ZMMU collection	Average of population	No. M.3940 sex. 12 July 1932 Sakhalin, Argi-Pagi. A. Rekst. S.I. Ognev's collection	No. M.3945 ♂ 7 May 1925. Estuary of Anaur river, Bol'shoi Shantar Island. Dul'keit. S.I. Ognev's collection	♂ 9 July 1928. Goryun river, tributary of Amur. A.K. Vernander	No. 16 ♂ 14 Oct. 1932. Khor river, tributary of Amur. K.A. Vorob'ev	Average
Length of body and head	148.2	—	—	—	—	—	—	148.2	—	139	—	147	143.0
Length of tail	114.8	—	—	—	—	—	—	114.8	—	124	—	—	118
Length of hind feet	36	—	—	—	—	—	—	36.0	—	33	—	37	32.0
Length of ear	16.5	—	—	—	—	—	—	16.5	—	14.5	—	15	14.8
Length of skull	40	40.6	40.6	39.2	41.8	39.6	40	40.2	39.3	38.2	39	39.2	38.9
Basal length of skull	32.1	31.8	32.4	31.2	—	32.1	—	32.1	30.6	30.3	31.1	32.3	31.1
Condylobasal length of skull	37	36.6	38	36.1	38	36.6	—	37.1	36.2	35.2	36.1	37.2	36.1
Interorbital space	18.1	18.3	18.6	17.1	18.3	18.2	—	18.1	18	16.9	17.2	17.6	17.4
Greatest width of skull	11	10.8	10.7	10.2	11.3	11.2	11.2	10.8	11.3	10.3	10.6	10.9	10.7
Zygomatic width	23	22.6	23.8	22.7	23	23	22	22.8	22.4	21.1	20.3	22.3	21.5
Height at level of bullae osseae	14	15.6	14.2	14.1	14.1	15	15.2	14.6	15.2	14.3	15	15	14.9
Height of bony palate	9.2	9.2	10.1	9.6	10	8.9	8.7	9.4	9.6	9.1	8.5	9	9.2
Length of nasals	13.2	13.3	13.1	12.2	13.6	13	13	13.2	12.9	12	12	11.6	12.2
Length of braincase	20.1	21.1	21	20.1	21.1	20.2	21.2	20.6	20	19.6	19.8	20.3	19.9
Width of rostrum	6.2	6	7	6.6	7	6.2	6.3	6.5	6.3	5.7	5.7	6.7	6.1
Length of bullae osseae	8.3	8.6	9.1	8.9	8.6	8.9	—	8.8	9	8.2	8.3	8.3	8.4
Width of bullae osseae	6.8	6.9	6.9	6.2	6.6	6.9	—	6.5	6.3	6.8	6.2	7	6.6
Length of upper tooth row	6.3	6.6	6.7	6.8	6.7	7.1	6.6	6.6	6.3	6.5	6.2	6.9	6.5
Length of lower tooth row	6	6.3	6.3	6.3	6.3	6.2	6.2	6.2	6.3	6.7	6	6.2	6.3
Width of infraorbital foramina	8.7	8.8	8.8	8.9	9	8.3	8.8	8.8	8.2	7.6	8.2	8.8	8.2
Age	Senex Teeth worn	Adult. Teeth not worn	Adult. Teeth not worn	Adult. Teeth not worn	Senex Teeth worn	Adult. Teeth moderately worn	Yearlings Teeth not worn		Adult. Teeth moderately worn	Adult. Teeth not worn	Senex Teeth strongly worn	Adult. Teeth hardly worn	


Small pika (Ochotona
Northern pika (Ochotona
20
10
ich
Arkhangel'sk
Sverdlovsk
50

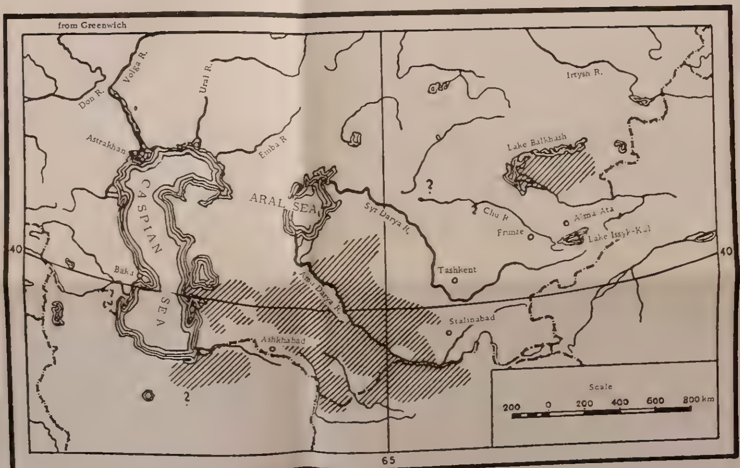

from Greenwich
GEOGRAPHICAL DISTRIBUTION OF SQUIRRELS
Arctic Circle
Leningrad
Arkhangel'sk
Moscow
Minsk
Kiev
Khar'kov
Rostov
Astrakhan
Batumi
Yerevan
Tbilisi
Baku
Sverdlovsk
Novosibirsk
Irkutsk
Chita
Yakutsk
Khabarovsk
Vladivostok
Ashkhabad
Stalinabad
Tashkent
Frunze
Alma Ata
Scale
300 0 300 600 900 km
I
II
III
IV
V
VI
VII
VIII
IX
X
XI
XII
XIII
XIV
XV
XVI
XVII
XVIII
XIX
XX
XXI
XXII

MAP VI. Geographical distribution of subspecies of Sciurus vulgaris in the U.S.S.R.

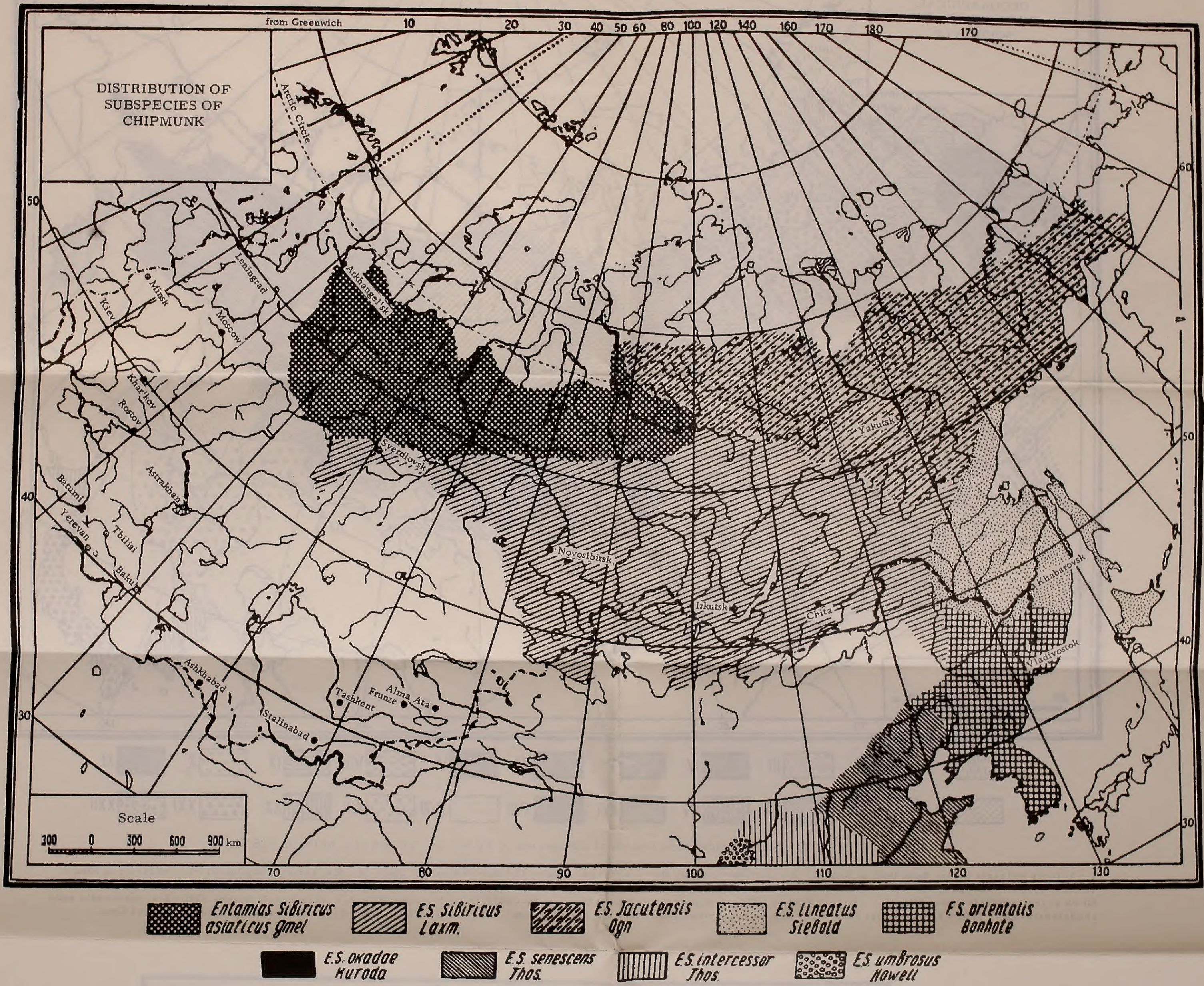
I — Sciurus vulgaris varius Barret-Ham. ex Kerr, II — S v. formosovi Ognev, III — S. v. ognevi Migulin; IV — S. v. fedjushini Ognev; V — S. v. kessleri Migulin, VI — S. v. ukrainicus Migulin, VII — S. v. bashkiricus Ognev; VIII — S. v. bashkiricus natio uralensis Ognev; IX — S. v. martensi Matschie; X — S. v. subsp? (transitional between martensi and exalbidus); XI — S. v. exalbidus Pall, XII — S. v. jenissejensis Ognev; XIII — S. v. altaicus Serebren., XIV — S. v. jacutensis Ognev, XV — S. v. fusconigricans Dvigubski, XVI — S. v kalbinensis Selevin, XVII — S. v. jacutensis natio anadyrensis Ognev; XVIII — S. v. rupestris Thos., XIX — S. v. mantchuricus Thos., XX — S. v. orientis Thos.; XXI — S. v. lis Thos.; XXII — Sciurus (Tenes) persicus anomalus Gmel.


from Greenwich
45
44
Rostov
Manych R.
SEA OF AZOV
Kuban R.
BLACK SEA
Kuma R.
Terek R.
Rioni R.
Batumi
Kura R.
Tbilisi
Alazan' R.
Volga R.
Astrakhan
Gurev
CASPIAN SEA
Baku
Lake Sevan
Araks R.
Murat R.
Scale
100 0 100 200 300 km

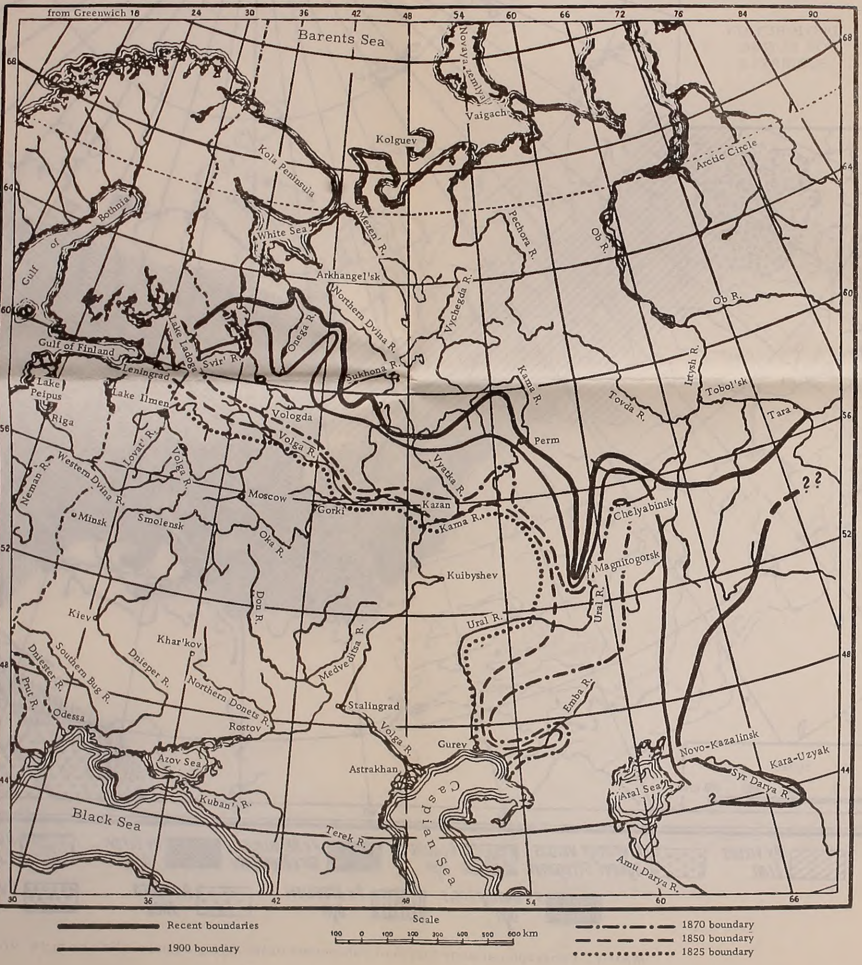
MAP VII. Distribution of Sciurus (Tenes) persicus anomalus Gmel.


from Greenwich
Don R.
Volga R.
Ural R.
Astrakhan
Emba R.
CASPIAN SEA
ARAL SEA
Baku
Ashkhabad
Amu Darya R.
Syr Darya R.
Irtysh R.
Lake Balkhash
Chu R.
Frunze
Alma Ata
Lake Issyk-Kul
Tashkent
Stalinabad
40
65
Scale
200 0 200 400 600 800 km

MAP VIII. Geographical distribution of Spermophilopsis leptodactylus Licht.

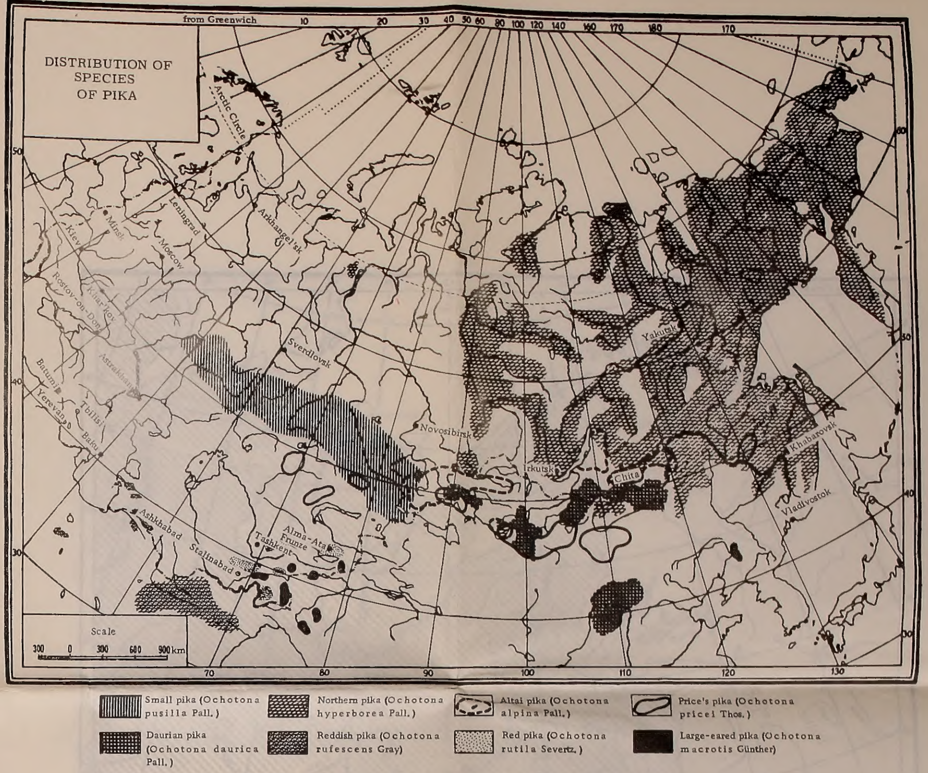

DISTRIBUTION OF SUBSPECIES OF CHIPMUNK
from Greenwich
10
20
30
40
50
60
80
100
120
140
160
170
180
170
Arctic Circle
Leningrad
Minsk
Kiev
Moscow
Arkhangel'sk
Khar'kov
Rostov
Astrakhan
Batumi
Yerevan
Tbilisi
Baku
Sverdlovsk
Novosibirsk
Irkutsk
Chita
Yakutsk
Khabarovsk
Vladivostok
Ashkhabad
Stalinabad
Tashkent
Frunze
Alma Ata
50
40
30
60
50
40
30
70
80
90
100
110
120
130
Scale
300
0
300
600
900 km
Entamias Sibiricus asiaticus Gmel
E.S. Sibiricus Laxm.
E.S. Jacutensis Ogn
E.S. Lineatus Siebold
F.S. orientalis Bonhote
E.S. okadae Kuroda
E.S. senescens Thos.
E.S. intercessor Thos.
E.S. umbrosus Howell

MAP IX. Geographical distribution of Eutamias sibiricus Laxmann.


from Greenwich
Barents Sea
Novaya Zemlya
Vaigach
Kolguev
Kola Peninsula
White Sea
Gulf of Bothnia
Gulf of Finland
Arctic Circle
Arkhangel'sk
Mezen' R.
Pechora R.
Ob R.
Northern Dvina R.
Onega R.
Vychegda R.
Sukhona R.
Lake Ladoga
Svir' R.
Leningrad
Lake Peipus
Lake Ilmen
Riga
Vologda
Volga R.
Kama R.
Tovda R.
Irtysh R.
Tobol'sk
Tara
Perm
Vyatka R.
Lovat' R.
Western Dvina R.
Neman R.
Minsk
Smolensk
Moscow
Gorki
Kazan
Oka R.
Chelyabinsk
Magnitogorsk
Kuibyshev
Ural R.
Don R.
Kiev
Khar'kov
Dnieper R.
Southern Bug R.
Dniester R.
Prut R.
Odessa
Northern Donets R.
Rostov
Medveditsa R.
Stalingrad
Emba R.
Gurev
Astrakhan
Azov Sea
Kuban' R.
Black Sea
Caspian Sea
Terek R.
Aral Sea
Novo-Kazalinsk
Kara-Uzyak
Syr Darya R.
Amu Darya R.
Recent boundaries
1900 boundary
Scale
100 0 100 200 300 400 500 600 km
1870 boundary
1850 boundary
1825 boundary

MAP II. Changes of the range of the common hare

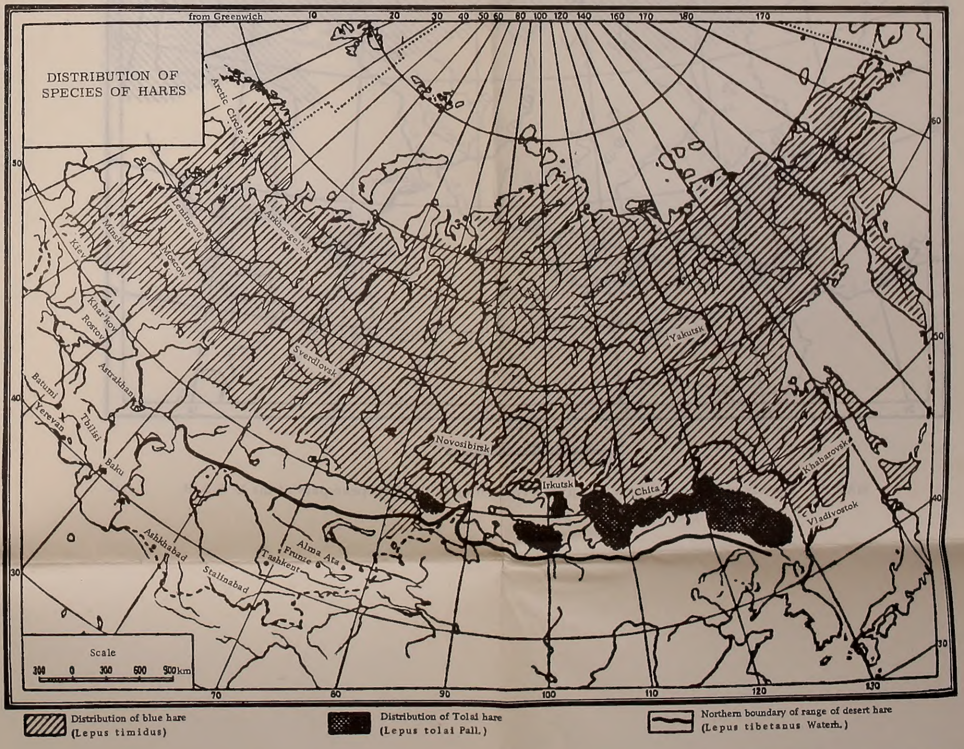
1254


DISTRIBUTION OF SPECIES OF PIKA
from Greenwich
Arctic Circle
Leningrad
Minsk
Moscow
Kiev
Arkhangel'sk
Rostov-on-Don
Astrakhan
Sverdlovsk
Batumi
Yerevan
Tbilisi
Baku
Novosibirsk
Irkutsk
Chita
Yakutsk
Khabarovsk
Vladivostok
Ashkhabad
Stalinabad
Tashkent
Frunze
Alma-Ata
Scale
300 0 300 600 900 km
Small pika (Ochotona pusilla Pall.)
Northern pika (Ochotona hyperborea Pall.)
Altai pika (Ochotona alpina Pall.)
Price's pika (Ochotona pricei Thos.)
Daurian pika (Ochotona daurica Pall.)
Reddish pika (Ochotona rufescens Gray)
Red pika (Ochotona rutila Severtz.)
Large-eared pika (Ochotona macrotis Günther)

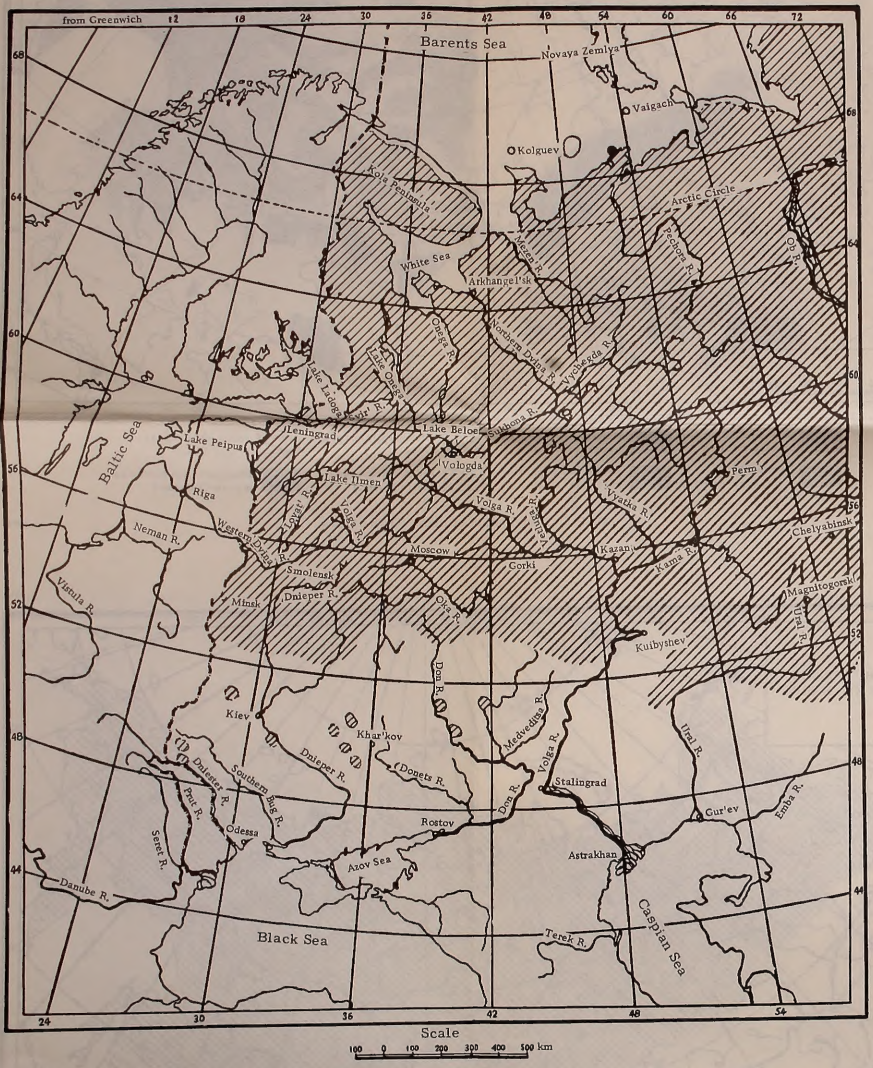
MAP I. Distribution of pikas (Ochotona)

1254

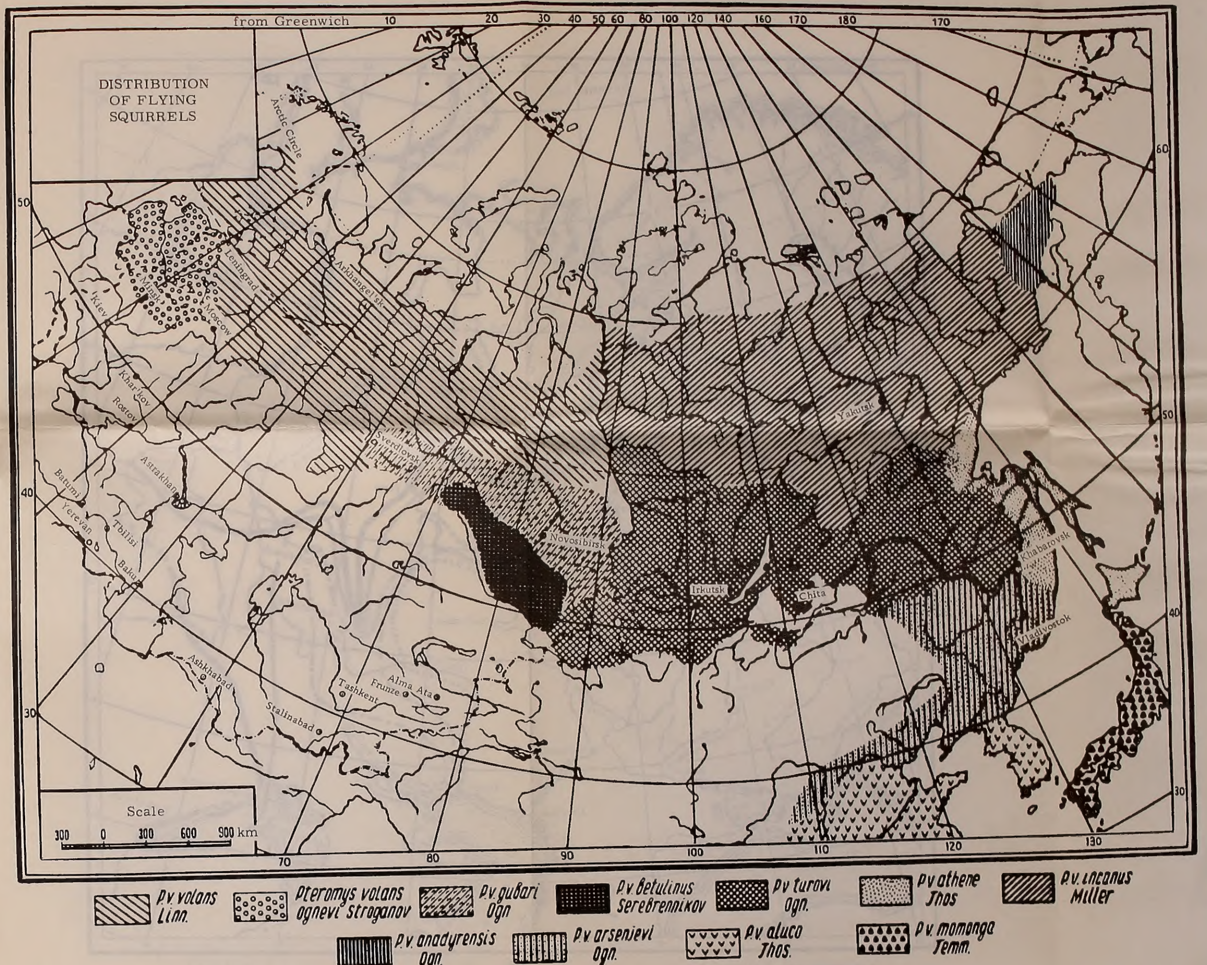
1254


DISTRIBUTION OF SPECIES OF HARES
from Greenwich
Arctic Circle
Leningrad
Minsk
Moscow
Kiev
Arkhangel'sk
Khar'kov
Rostov
Astrakhan
Sverdlovsk
Batumi
Yerevan
Tbilisi
Baku
Novosibirsk
Irkutsk
Chita
Yakutsk
Khabarovsk
Vladivostok
Ashkhabad
Stalinabad
Tashkent
Frunze
Alma-Ata
Scale
300 0 300 600 900 km
Distribution of blue hare (Lepus timidus)
Distribution of Tolai hare (Lepus tolai Pall.)
Northern boundary of range of desert hare (Lepus tibetanus Waterh.)

MAP III. Geographical distribution of blue hare (Lepus timidus), Tolai hare (Lepus tolai) and desert hare (Lepus tibetanus)


from Greenwich
Barents Sea
Novaya Zemlya
Vaigach
Kolguev
Kola Peninsula
White Sea
Arctic Circle
Arkhangel'sk
Mezen R.
Pechora R.
Ob R.
Onega R.
Northern Dvina R.
Vychegda R.
Lake Ladoga
Lake Onega
Svir' R.
Lake Beloe
Sukhona R.
Vologda
Leningrad
Lake Peipus
Baltic Sea
Riga
Lake Ilmen
Lovat' R.
Volga R.
Kama R.
Vyatka R.
Perm
Chelyabinsk
Magnitogorsk
Ural R.
Neman R.
Western Dvina R.
Smolensk
Moscow
Gorki
Kazan
Minsk
Dnieper R.
Oka R.
Kuibyshev
Vistula R.
Don R.
Kiev
Khar'kov
Donets R.
Medveditsa R.
Stalingrad
Dniester R.
Southern Bug R.
Prut R.
Seret R.
Odessa
Rostov
Gur'ev
Emba R.
Azov Sea
Astrakhan
Danube R.
Black Sea
Terek R.
Caspian Sea
Scale
100 0 100 200 300 400 500 km

MAP IV. The range of the blue hare (Lepus timidus) in the European part of the U.S.S.R.


from Greenwich
DISTRIBUTION OF FLYING SQUIRRELS
Arctic Circle
Leningrad
Arkhangel'sk
Moscow
Kiev
Khar'kov
Rostov
Sverdlovsk
Astrakhan
Batumi
Yerevan
Tbilisi
Baku
Novosibirsk
Irkutsk
Chita
Yakutsk
Khabarovsk
Vladivostok
Ashkhabad
Tashkent
Frunze
Alma Ata
Stalinabad
Scale
300 0 300 600 900 km
▨ P.v. volans Linn.
Pteromys volans ognevi Stroganov
P.v. gubari Ogn
P.v. betulinus Serebrennikov
P.v. turovi Ogn.
P.v. athene Thos
P.v. incanus Miller
P.v. anadyrensis Ogn.
P.v. arsenjevi Ogn.
P.v. aluco Thos.
P.v. momonga Temm.

MAP V. Geographical distribution of subspecies of the flying squirrel (Pteromys volans)

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